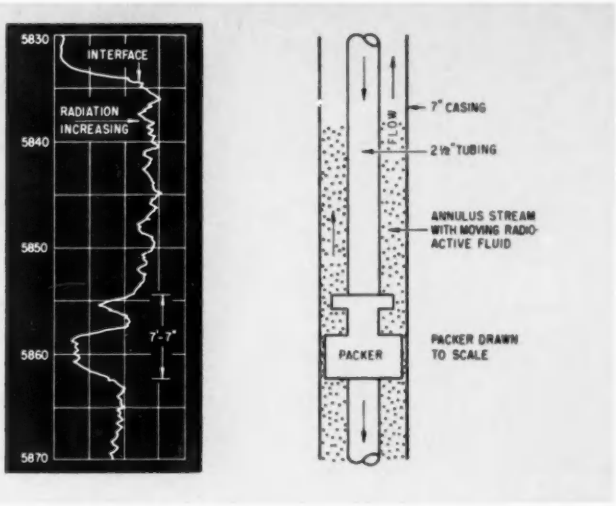
Oil injectivity surveys evaluate well remedial work

PAGE 51



Radio reflection method finds oil and gas directly

PAGE 54

THE UNIVERSITY OF MICHIGAN
MAR 13 1961
SCIENCE LIBRARY

WORLD OIL

SPECIALIZED FOR EXPLORATION, DRILLING AND PRODUCING OPERATIONS AND MANAGEMENT

MARCH 1961

How to start a waterflood 58
Foaming agents aid air drilling 59
New notching tool pays off 65
Nebraska's hottest oil play 80
New look at oil economics 86

SUBSCRIPTION PRICE $2 PER YEAR • SINGLE COPY PRICE 50 CENTS

Which treatment makes the better well ?

These inside-the-well-bore views of enlarged sections of treated formation, as visualized by an engineer, compare two methods of stimulation.

The top illustration represents a sand-packed fracture after conventional fracturing. This type of treatment often gives good production increases at low cost. Many wells, however, do not respond profitably to these treatments. Small production increases, rapid production declines, or trouble with sand returns may limit profits.

The bottom illustration depicts the probable result of a new type of Dowell treatment. It uses slow-reacting Retarded Acid injected at a high rate to create open flow channels over a large drainage area. Since the etched formation supports itself, there is no need for using sand that might crush, imbed, or flow back with production. This new treatment technique is giving excellent production increases in many areas.

Which treatment is better for you? Your Dowell representative can help you decide when he knows the facts about *your* well, *your* production requirements and *your* profit objectives. Check with him now! Dowell services and products are offered from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina, Germany, France and the Sahara area. Dowell, Tulsa 1, Oklahoma.

SERVICES FOR THE OIL INDUSTRY **DOWELL** DIVISION OF THE DOW CHEMICAL COMPANY

Established 1916 as The OIL WEEKLY®

VOLUME 152, NO. 4 MARCH 1961

WORLD OIL

A Gulf Publishing Company Publication

SPECIALIZED FOR EXPLORATION, DRILLING AND PRODUCING OPERATIONS AND MANAGEMENT

A Quick Look at This Issue

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following pages, checking ☐ those you want to read first.

☐ **Oil injectivity surveys evaluate well remedial work . . .** Texaco Inc. has found oil injectivity profile logging to be an excellent means of determining the effectiveness of acidizing, fracturing, perforating, squeeze cementing and sand consolidation work. Casing leaks, leaks around the casing shoe and plugged perforations and liners also have been located. For complete details, see ..... **Page 51**

☐ **New radio reflection method finds oil and gas directly . . .** This new exploration method, which relies only on the presence or absence of hydrocarbons in the subsurface, has been developed and proven in the field. Furthermore, advance depth estimates of hydrocarbons have been borne out. For the first published report on this promising new method, turn to. . **Page 54**

☐ **How to start a waterflood . . .** For a complete outline of essential steps which should be considered prior to installing a waterflood project, see..... **Page 58**

☐ **How to use foaming agents while drilling with air or gas . . .** Use of foam producing agents to remove cuttings and water at operable pressures has done much to extend the use of air drilling to wells with water flows of up to 200 barrels per hour. For an informative report on the chemicals, equipment and techniques used, plus associated problems and potentials of foaming agents, turn to..... **Page 59**

☐ **New notching tool improves fracturing . . .** A mechanical tool equipped with special blades has been developed for notching a wellbore prior to hydraulic fracturing. Good results have been obtained in some 40 cases at depths to 8,822 feet and in casing from 4½ to 7⅝ inches in diameter, see..... **Page 65**

CURRENT OUTLOOK

Russian competition highlighted at AIME 7
Cold winter causes good business in oils 13
Drilling continues downward trend 17
Central Nebraska oil play gains momentum
Joseph A. Kornfeld 80
Industry earnings recovering after three years of trouble
L. J. Logan 85
Where does oil stand in the cost allowable price squeeze? 86
Sinclair pulls a switch in computer training 87

EXPLORATION

New radio reflection method finds oil and gas directly
Harrison T. Brundage 54
Mobile magnetometer gives rapid regional coverage
Walter E. Heinrichs, Jr. 82

DRILLING

How to use foaming agents in air and gas drilling
W. C. Goins, Jr. and H. J. Magner 59
Index maps aid air/gas drilling operations
Anthony Gibbon 69
Drilling fluids in the Rocky Mountain area
Homer B. Brown, Jr. 74

PRODUCTION

Oil injectivity surveys evaluate well remedial work
Richard H. Widmyer 51
How to start a waterflood
L. J. Hays, Jr. 58
New notching tool improves fracturing
J. L. Pekarek, V. N. Swift and H. L. Strider 65
Automatic gas well dewatering system cuts costs
M. C. Gillis 71

DEPARTMENTS

Looking ahead 7
Editorial page 11
Changing panorama 13
Drilling activities 17
Practical operating hints 28
Industry at work 90
Men in the industry 96
Who's meeting where 111
Associations 113
Suppliers' notes 116
Squeaks from the bullwheel 124
Trading post 129
Classified advertising 129
What's new in equipment 132
New literature 142
Advertisers in this issue 144

WORLD OIL published every month except semi-monthly in February and August. Second class postage paid at Houston, Texas. ©Gulf Publishing Co. 1961.

☐ **Index maps aid air/gas drilling operations . . .** Here is an entirely new approach in assessing the possibilities of air/gas drilling. These index maps provide a convenient and comprehensive guide, pointing out where well cost reductions may be possible by using air/gas drilling, see ..... **Page 69**

☐ **Automatic gas well dewatering system cuts costs . . .** New Pan American system in Hugoton field uses water sensing device to regulate unloading frequency. Installation reduces vented gas to a minimum, maintains annulus water level at bottom of tubing, requires no regular personnel attention and is self-compensating for changes in line pressure and water production. For a complete description of this automatic installation, see ..... **Page 71**

☐ **Drilling fluids in the Rocky Mountain area.** Economic considerations have caused considerable re-evaluation of the present mud systems. Operators are finding that planned mud programs are decreasing mud materials costs, lowering drilling and completions costs, and increasing drilling rates. For a discussion of the various types of mud programs that are presently being used in the Rocky Mountain area, see ..... **Page 74**

☐ **Central Nebraska oil play gains momentum . . .** Following the discovery of Red Willow County's Sleepy Hollow oil field last August, drilling activity has spread to nine central Nebraska counties. For an up-to-date report on current activity, prospects for the future, geology of the area, plus an exclusive interview with the leading drilling contractor in the area, turn to . . **Page 80**

☐ **Mobile magnetometer gives rapid regional coverage . . .** A reconnaissance magnetic profile was run along highways from Lucy, east of Albuquerque, N. M., northeastward to the Texas border. The profile covered 200 miles in a period of about five hours. This type of survey is intermediate in detail and speed between the airborne magnetometer and the manual ground method ..... **Page 82**

☐ **Where does oil stand in the cost-allowable-price squeeze? . . .** While the economic outlook for integrated companies continues to improve, the picture is far from promising for independent crude oil operators. For a timely appraisal of the industry's economic status, what should be done about it, plus several new barometers showing how the independent crude oil producers are faring, turn to ..... **Page 86**

☐ **Sinclair's novel approach to computer training . . .** When its new high speed computers go into operation next year, Sinclair will have no centralized computer department—programing will be handled by company personnel rather than by outsiders not familiar with the oil industry. For complete details on the advantages of this new idea, plus an informative report on the company's new computer training school, turn to ..... **Page 87**

Oil Industry in Brief

Here are the latest industry trends, revealed by WORLD OIL and industry research.

Demand sets records. January demand for all oils averaged 11.37 million barrels daily, up 6.5 percent over same 1960 period—for highest first month demand in history, and close to all-time high of 11.5 million barrels daily reported during December 1958.. See Page 13.

Gasoline consumption increases. Gasoline demand averaged 3.7 million barrels daily in January, up 2.5 percent from January 1960. End of month stocks totaled 211.8 million barrels, up 2.8 percent over January 31, 1960 . . . See Page 13.

Allowables increased. Supply - demand balance that would encourage reasonable crude price hike may be endangered by recent increases in some state allowables, i.e., Texas upped March schedules to 10 days, from 8 in February for 204,000 barrels per day increase.

Outlook good for integrated companies. After sagging for 18 months, oil company profit margins made a dramatic turn in mid-1960 and have now reached best level in more than 3 years . . . See Page 85.

Russian exports increase. A heavy importer of coal and oil in 1950, Soviet Union now is exporting more than 7 million metric tons of coal and 180 million barrels of crude annually, with vigorous increases expected in fuel exports to Europe, Asia and Latin America . . . See Page 7.

Well completions down. January new well completions totaled 3,641, down 10.7 percent from January 1960, and 16 percent from January 1959 . . . See Page 17.

Rig activity hits rock bottom. Only 3,252 cable tool and rotary rigs were reported operating on January 31, down 259 rigs or 7.4 percent from December's end and 450 rigs or 12.1 percent from January 31, 1960 . . . See Page 17.

WORLD OIL

RAY L. DUDLEY, Founder, 1891-1957

WILLIAM G. DUDLEY.....Publisher
DONALD E. KLIEWER.....Editorial Director
L. J. LOGAN.....Associate Editor
DON E. LAMBERT.....Associate Editor, Current Outlook
WALLACE FITZGERALD.....Managing Editor
ROBERT W. SCOTT.....Engineering Editor
JACK F. EARL.....Engineering Editor
HARRISON T. BRUNDAGE.....Exploration Editor
GILBERT M. WILSON.....Western District Editor
ANTHONY GIBBON.....Mid-Continent District Editor
JACK COCKERHAM.....Presentation Editor
FERN C. REED.....Editorial Assistant
JOHN BRADLEY.....Editorial Assistant
DOLORES REYNOLDS.....Editorial Assistant
GARY DUNHAM.....Editorial Assistant
EUNICE M. OKONESKI.....Librarian

WORLD OIL
Is Published By
GULF PUBLISHING COMPANY

EXECUTIVE OFFICES: 3301 BUFFALO DRIVE, HOUSTON
Cable Address, Gulfpubco, Houston
World's Largest Specialized Publishers to the Oil Industries

WILLIAM G. DUDLEY.....President
TOM W. NELSON.....Vice Pres.-Gen. Mgr.
R. M. DE SOMBRE.....Vice Pres.-Asst. Gen. Mgr.
NELSON L. BIGELOW.....Vice President Sales
MRS. RAY L. DUDLEY.....Vice President
P. J. AUCOIN.....Treasurer

ADVERTISING

HOUSTON (1)—P. O. Box 2608
Charles Wyatt, C. A. Davis, Cecil W. Smith
Phone JAckson 9-4301

SUMMIT, NEW JERSEY—382 SPRINGFIELD AVE.
Sam Sorrell, Phone CRestview 7-1221

CLEVELAND (16)—20800 CENTER RIDGE ROAD
Bill Westfall, Phone EDison 3-1650

CHICAGO (46)—6039 N. CICERO AVENUE
Al Seymour, Phone AVenue 2-4333

LOS ANGELES—1810 FAIR OAKS AVE., SOUTH PASADENA
Jay Curts, Jim Merrill, Phone MUrray 2-3518

TULSA (3)—916 ENTERPRISE BUILDING
Gene Hart, Phone LUther 2-9211

DALLAS (8)—1808 SYLVAN DRIVE
Ed Thompson, Phone RIverside 7-7344

LONDON, ENGLAND—120 MOORGATE, E. C. 2
Frank Chambers, Agent, Phone MOnarch 5661

KOLN-BRAUNSFELD, GERMANY—AACHENER STRASSE 378,
Gerd Hinske, Phone 52 22 60

Advertising rates on application.

SUBSCRIPTIONS

R. B. Reilly, Circulation Manager, P. O. Box 2608, Houston 1, Texas, U.S.A. Single copies 50 cents (except special issues). Double prices for single copies more than a year old. Subscription rates: both foreign and domestic $2 a year.

Copyright 1961 by Gulf Publishing Company. WORLD OIL and THE OIL WEEKLY are registered trademarks of Gulf Publishing Company, Houston, Texas.

Postmaster: Send notification (Form 3579) regarding undeliverable magazines to WORLD OIL, Box 2608, Houston 1, Texas.

GPC PUBLICATIONS

WORLD OIL (formerly The Oil Weekly) and The COMPOSITE CATALOG for the drilling-producing industry.
PIPE LINE INDUSTRY and The PIPE LINE CATALOG for the oil and gas pipe line industry.
PETROLEUM REFINER and The REFINERY CATALOG for the hydrocarbon processing industry.

Indexed by Industrial Arts Index and Engineering Index

Next month

"For better interpretation—let's get back to the rocks"—the theme of the April 1961 Exploration Progress Issue of WORLD OIL—is illustrated by Exploration Editor Harrison T. (Spud) Brundage as he examines portions of rotary cuttings sample during recent visit with E. P. Roederer, Jr., paleontological supervisor, Phillips Petroleum Company in Lafayette, La.

'Let's get back to the rocks'

WITH PROGRESSIVELY fewer structures remaining to be drilled, the need for improved geological and geophysical interpretation is becoming critical.

To meet this need, oil hunters are returning to a more basic study of the rocks that contain and surround crude oil and natural gas. A constantly increasing emphasis is being placed on stratigraphic traps. Geologists are renewing and enlarging their knowledge of sedimentary geology.

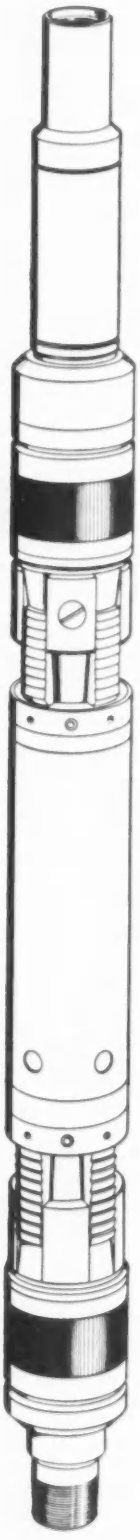
Geophysicists also are taking a closer look at the real nature of the rocks. Exploratory approaches are being considered in the light of the geologic traits of each area.

So that our readers may be brought up-to-date on this significant trend back to the rocks, WORLD OIL will publish the following feature articles in the April Issue:

- How to analyze strandlines
- How lithologic zoning of dolomites helps find oil
- How to speed microfossil separation
- Reconstruct oil-forming environments with facies studies
- Latest techniques in photogeologic interpretation
- How to collect better rotary cuttings.

. . . And these are just a few of the topics to be covered. *So—be sure to watch for your April Exploration Issue. It will contain the most timely, complete and accurate report on the latest trends in exploration published to date.*

BROWN
HS-16-1 PACKERS FOR DOWN-HOLE PROFITS



HS stands for "Hydraulically Set" in the type designation of this advanced design, multi-purpose packer because it is simply set by hydraulic pressure.

HS also stands for "Highly Salvable" because this packer is readily retrievable and may be rerun immediately after servicing.

HS also stands for "Hydrogen Sulfide" because this packer – without springs on wiper blocks to become embrittled, with lead seals to protect the synthetic rubber seals, and with H_2S resistant materials throughout – is ideal for areas where H_2S is encountered. But, however you name it, no other packer has the versatility or offers the profit making advantages of the Brown HS-16-1. Just check these money saving features:

MULTI-PURPOSE • A packer for single zone completions • A packer for single-string dual completions • As the lower packer in multiple-string completions • As the packers (any number in the same well) for multiple alternate-zone installations. • An excellent packer where acidizing or fracturing is being done. Dual slips enable the packer to withstand high differential pressures – pressure exceeding tubing limit.

RUNNING • **Circulation with the well head in place,** and before setting the packer eliminates wire line work. • Savings in rig time while running and setting. Ample by-pass area allows free flow of well fluid around the packer. • The HS-16-1 is easily run in straight or deviated holes. • No difficulty in running the packer into the top of a liner.

SETTING • **Positive well control is achieved since the well head is installed before the packer is set** or drilling fluid displaced. • **Producing zones may be washed after the well head is installed.** • No tubing manipulation necessary to set packer. • Design eliminates the possibility of premature setting. • The "hydraulically-set" feature minimizes the problem of spacing out. • Set at any depth as no tubing weight is required when setting. Hydraulic setting allows the tubing to remain in tension due to its own weight. • Treating fluid may be spotted across the producing zone before the packer is set.

PULLING • A fully retrievable packer, the HS-16-1 can be rerun after servicing. The cost of drilling and replacing a permanent-set packer is eliminated. • Swabbing action while pulling is minimized by the built-in equalizing valve and the ample by-pass area around the packer.

All of this adds up to down-hole profits from savings of time and materials, and the plus profit of added safety. The Brown HS-16-1 packers are available in all popular sizes or to your specifications on special order. Just call one of our representatives – they serve production areas throughout the free world.

BOT

BROWN OIL TOOLS, INC.

8490 KATY ROAD P. O. BOX 19236,
HOUSTON 24, TEXAS

Looking Ahead

Economics—Russian competition highlighted at AIME . . . **Soviet Union's mineral-fuel output increased 350 percent between 1946 and 1960.** Production of conventional fuel increased from 200 million metric tons in 1947 to 700 million last year, with goal of 1.5 billion tons by '72. So stated Dr. Dimitri Shimkin in reporting on "Soviet Oil Industry as Domestic Supplier in the World Market" before annual AIME meeting in St. Louis, February 26-March 2. A heavy importer of coal and oil in 1950, Russia was exporting 7 million metric tons of coal—180 million barrels of crude and products by 1959. Shimkin predicts vigorous increases in Soviet fuel exports to Europe, Asia and Latin America.

Acquistion of producing properties by outright purchase has been on the increase during past decade. Trend has been accelerated by depressed condition of petroleum industry, impact of taxes and increasing costs of replacing reserves. This observation was made by Wallace W. Wilson, Continental Illinois National Bank and Trust Company, in explaining ways in which producing property acquisition may be easily organized.

Oil's long-range outlook: exceptionally good . . . Universal Oil Products President and Chairman Maynard P. Venema says that from 1959 to 1975, U.S. energy consumption will increase 70 percent to an equivalent of 33.1 million barrels of crude oil daily, with oil accounting for at least 45 percent of the increase. Domestic refinery capacity will expand from current 10.2 million barrels daily to 15-16 million barrels.

Washington briefs . . . New fuels policy study resolution to investigate current and future U.S. fuel resources, with findings due to be reported to Congress by April 1, 1963 is expected to be given early green light. House Interior Committee Chairman Aspinall's proposal calls for Joint Committee on National Fuels Study comprising 8 senators and 8 representatives . . . **Although President Kennedy has strongly recommended federal gasoline tax increase from 4 to 4½ cents when "temporary" increase expires next June,** proposals to cut tax back to 3 cents still are very much alive . . . **Industry leaders are showing concern over Interior Secretary Udall's statement** that outlook is for increasingly close involvement of government in industry—that fuels policy study is overdue—and that U.S. must have national policies on oil and gas . . . **Commerce Secretary Hodges predicts** Kennedy Administration will back tax break for industry, probably by proposing "accelerated" depreciation on equipment; however, stiff opposition is expected from Senate Finance Committee.

Upturn in U.S. wildcatting by 1963? . . . During the period 1937-1959, level of seismograph activity in the U.S. has been closely indicative of wildcatting rates four years later. When seismograph activity increased or decreased in a given year, number of wildcats completed increased or decreased accordingly, *four years later.* Seismograph crew activity in the U.S. fell from 1955 through 1958, rising slightly in 1959. Thus, it appears possible that wildcatting will continue to decline in the United States through 1962, turning upward in 1963.

New discovery brightens east Michigan prospects . . . In mid-February, a new Niagaran reef discovery was completed in Macomb County, producing 2 MMcf gas and 35-42 barrels of oil per day. Wildcat, producing from reef's A-1 section at 2,608 feet, originally was drilled to 4,690 feet, with Trenton testing dry. Recent developments in St. Clair County, plus Macomb find, are expected to sharply increase Michigan drilling activity in coming months.

Save on oil exploration and production costs with '61 FORD TRUCKS

FORD HEAVIES SAVE WITH DOUBLE THE CAB, SHEET METAL AND RADIATOR LIFE

Ford F-Series Heavy Duty models are especially designed for the rugged terrain and tough conditions generally found on exploration and production jobs. Their new independent mounting system for cab and radiator effectively separates both from the adjacent sheet metal assemblies for much greater durability. And radius rod-leaf type rear springs provide better axle alignment, longer spring life.

The electrical wiring system has been improved for greater reliability. Chassis wiring is fastened within the protection of the frame web, away from mud, ice and snow. Ford Truck frames have been engineered to make the mounting of bodies and special equipment easier. And a new 212-inch wheelbase model is available to accommodate extra-long bodies.

Save with Ford Heavy Duty Tandems for exceptional durability, payloads and low operating expenses. Ford T-700, T-750 and T-800 Tandems with HD V-8 engines have rugged double-channel frames that are built to take tortuous off-road treatment. And they provide a wider range of chassis options so you can choose the right power train and load-carrying components for any job. Eaton and Timken rear axles are now available in bogie assemblies with 22,000-, 28,000-, 30,000- and 34,000-lb. capacities. And lightweight aluminum walking beams, wheels and gas tanks are available to keep chassis weights low . . . payloads high.

Ask your Ford Dealer about Ford's full tandem line . . . including Super Duties with 38,000-lb. bogies for up to 51,000-lb. GVW!

A fundamental problem is emphasized again

INTERIOR SECRETARY UDALL'S recent hearing on residual imports again emphasizes the urgent need for oil industry accord when public issues arise. Despite constant urging of oil leaders not to air differences in public, three divergent viewpoints were presented during the one-day meeting—two from the oil industry.

Those differences were laid bare before the public through every news medium.

• **On one side were the crude oil marketers and consumer groups** who favor the removal of all restrictions on residual imports. These groups say residual import curbs:

- . . . are of no economic consequence to oil.
- . . . create an adverse effect on fuel oil consumers by limiting their freedom of choice and making uncertain their access to a stable residual supply.
- . . . impair this nation's relationship with friendly nations.
- . . . will not help alleviate unemployment in the coal industry.
- . . . are not required in the interest of national security.

• **On the opposite side are the coal interests,** who say rigid import restrictions are needed to:

- . . . prevent a serious energy gap in a national emergency.
- . . . ease unemployment in coal producing areas.
- . . . give coal a fair opportunity to compete in the marketplace.
- . . . avoid "fantastic administrative problems" in New England.
- . . . reduce the need for "federal internal policing."

• **Somewhere in the middle are the independent crude oil producer groups,** who say:

- . . . reasonable limitations serve the interest of national security.
- . . . unrestricted imports could result in cuts in the amount realized from a barrel of crude oil and reduce funds for U.S. exploration and development.
- . . . residual imports should be restricted to use for residual purposes only and not be refined into or substituted for other relatively unneeded products.
- . . . any annual average increase in the total demand importation of residual fuel over the first full year of mandatory regulation (1960) should be deducted from non-residual import totals.
- . . . the calculation of non-residual imports in Districts I-IV should be based on 9 percent of total demand less demand for residual fuel.

As in other recent public issues, coal presented a united stand while oil was divided. Thus, advocates of greater federal control of industry's intricate economic machinery were handed new ammunition. If oil industry accord cannot be reached on residual imports, can it be achieved when the depletion provision, Landis' proposals for tighter industry regulation, or other aspects of the import program receive closer government scrutiny?

Certainly it can be achieved. But first, those who are responsible for the industry's future must acknowledge that growing federal control is by far the greatest danger to economic progress—by far greater than intra-industry differences on a single public issue.

Then, they must refuse to stand above intra-industry compromise—seek industry unity on public issues—get off the defensive and conduct aggressive information programs on critical matters, before those matters come to a head—and by all means speak out in unity where public opinion is involved.

Coal, labor and advocates of strict federal control can do it. So can oil.

WHAT MAKES A good waterflood Packer?

Waterflood service demands a packer that's long on performance and short on cost. The picture shows one that is. It is lean and clean, short and compact. Its packoff is positive and dependable, it has great holding power, it is easy to set and retrieve. What makes all these things possible in a low cost packer? See the facts below.

BAKER

Model A Retrievable Tension Packer

To get Bulletin 334, write
Baker Oil Tools, Inc.,
P. O. Box 2274,
Terminal Annex,
Los Angeles 54, Calif.

BAKER OIL TOOLS, INC. / HOUSTON / LOS ANGELES / NEW YORK

A quick look at the facts about this important retrievable pressuring tool

WHY IT WORKS SO WELL

A Baker Model A Retrievable Tension Packer is compact (and economical) because it is simple. Baker rocker type slips, for instance, have both simplicity and superior holding power – a good combination in any pressuring tool. They are one of the great advances in slip design in recent years. This packer also has a performance-proved packing element – and a full bore that permits running wire line tools or instruments.

WHERE AND HOW TO USE IT

1 It gets its main play in waterflooding.

2 It's also a squeeze packer for simple pressuring operations where you don't need the supervision of a Baker tool specialist. For instance: when fracturing in shallow or low-fluid-level wells.

3 There are times when you may want to leave a packer in the well after a pressuring operation. The low cost of a Baker Model A recommends it for such service.

4 There are also times when you may *have* to leave a packer in the well. For instance, when you've got defective casing and there's doubt you would be able to retrieve *any* packer. You can leave one of these low cost packers in the well and knock it down out of the way with little trouble or expense.

5 You can set and reset any number of times in one trip. It is rugged enough to be used many times in many wells.

6 It is simple to maintain and redress. Standard parts are available from Baker's many field service locations.

HOW TO SET AND RELEASE IT

A simple and reliable J-Slot makes this packer very easy to set and release.

1 To set packer, you rotate tubing ¼ turn to left to unjay the slips, then apply tension to pack off.

2 To release, you relax tubing tension to relax packing element and permit slips to retract, then rotate ¼ turn to right to lock them in retracted position. Now you can retrieve.

3 There are two safety release systems.

Cold winter causes good business in oils

By WORLD OIL Staff

THE INDUSTRY has been getting along exceptionally well in recent months, and it has high hopes for 1961. Business has been booming, primarily because of extremely cold weather in December, January, and the first half of February.

Very large sales of heating oil and kerosine and a moderately higher trend of gasoline consumption have pushed total demand for petroleum to about the highest levels ever recorded.

The total demand for all oils in January 1961 set a new record for the first month of any year. The demand of 11,369,000 barrels daily was approximately 700,000 barrels or 6.5 percent above that of a warmer January 1960 and somewhat exceeded that of a cold January 1959.

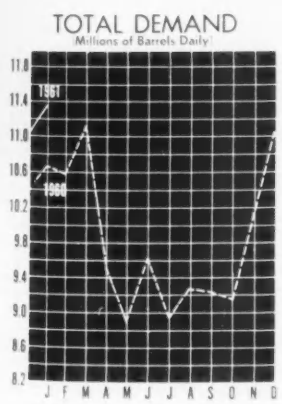
In December 1960 total demand for petroleum, averaging 11.0 million bpd, was about the same as in the final month of 1959, although less than the 11.5 bpd of December 1958, the all time record for any month of any year.

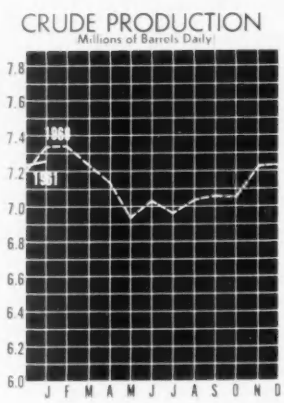
Distillate Use. The cold weather of January 1961 boosted demand for distillate fuel oil somewhat above the previous month's rate to 3,081,000 bpd. That was 275,000 barrels or 9.8 percent above demand in milder January 1960.

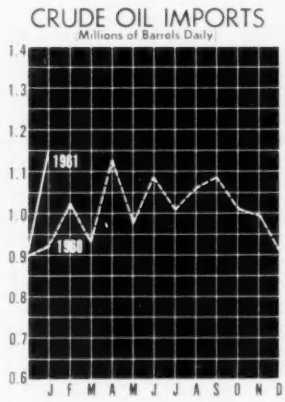
In meeting the demand for distillate, stocks were drawn down sharply in January 1961. They came down 28.4 million barrels or at the rate of 916,000 bpd. They then stood at only 111.8 million barrels. At the end of January a year ago they totaled 125.9 million barrels. Though that amount was excessive, the January 31, 1961, total was 14 million barrels or 11 percent lower.

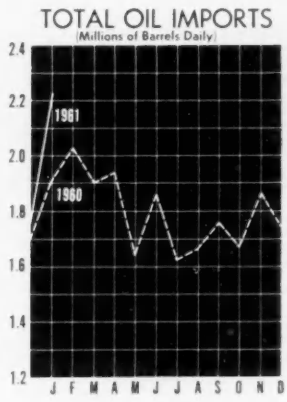
Because of the cold weather and heavy consumption, the distillate fuel oil markets have been strong, and prices advanced in January and February, after having been firm in December. The winter season consequently has been much more profitable than that a year ago. Last winter had relatively mild weather in December, January, and February, and heating oil prices were depressed. March 1960 had unusually cold weather, and heating oil surpluses were largely consumed, but the

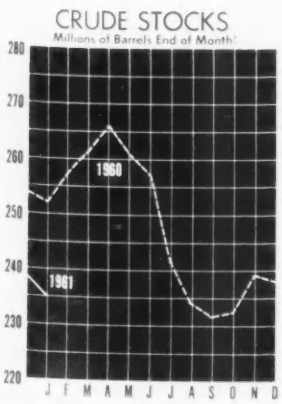
Petroleum Trends...

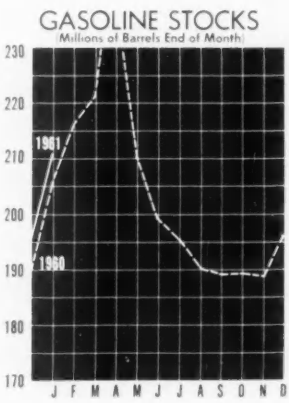


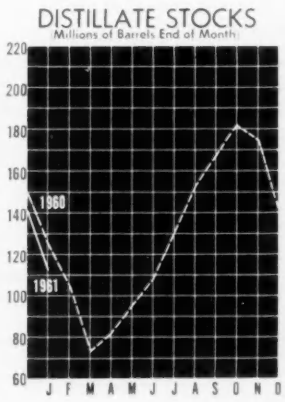


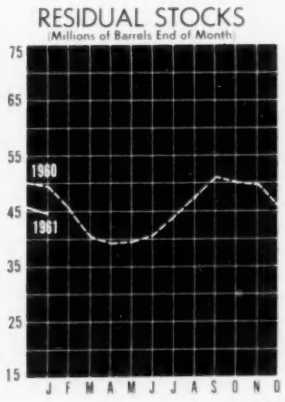












...in difficult areas

On the surface, tellurometers accurate to within inches over a fifty-mile traverse are visible indicators of GSI's new look at refraction shooting.

Looking deeper, recently developed refraction interpretation techniques, special refraction instruments and seismometers are giving GSI clients subsurface data in areas where it was unobtainable in the past.

If you have prospects which refuse to yield deep data through the use of reflection shooting our new look at refraction will interest you.

For additional details, write ....

GEOPHYSICAL SERVICE INC.

900 EXCHANGE BANK BLDG. • DALLAS 35, TEXAS

A TEXAS INSTRUMENTS COMPANY

weather had changed too late to help profits.

Kerosine has been a star performer among the industry's products during the past year. Demand for kerosine has increased sharply as a result of growing use in commercial jet planes.

The demand for kerosine in January 1961 averaged 600,000 bpd, about the same as in the previous month and an increase of 121,000 barrels or 25.3 percent over January 1960.

Residual fuel oil demand has continued under the year-ago trend. In January 1961 it averaged 1,908,000 bpd, a decrease of 134,000 barrels or 6.6 percent from January 1960. In December 1960 it had averaged 1,756,000 bpd, a drop of 180,000 barrels or 9.3 percent from the corresponding month a year earlier.

The lower trend of demand for residual reflects the business recession and slowing of industrial activity.

Gasoline demand in January 1961 averaged 3,711,000 bpd, down seasonally from the previous month but 91,000 barrels or 2.5 percent above January 1960. This increase occurred in spite of more severe weather than a year ago.

However, gasoline demand has been showing only small gains during the past year, compared with the year earlier trends. For the whole year 1960 it was up only 1 percent over 1959.

In view of the current limited growth of demand for gasoline, the quantities of that product in storage appear larger than desirable. U.S. stocks of gasoline at the end of January 1961 totaled 211.8 million barrels, an increase of 5.8 million barrels or 2.8 percent over the amount held January 31, 1960. This was a better situation, however, than at year end, when gasoline stocks of 196.9 million barrels were 9.8 million barrels or 5.2 percent above one year previously.

So far, the markets for gasoline are holding steady. But they will be under some pressure henceforth, as inventories climb to their seasonal, annual highs in March and April.

Another possible danger for the industry lies in the scheduled material increase in crude production allowables in Texas in March. The state will have 10 producing days, compared with 8 in February.

U.S. Petroleum Demand and Supply (Thous. Bbls. Daily)

ITEM	JANUARY 1961	JANUARY 1960	% Diff.	December 1960
DEMAND				
All Oils, Total Demand	11,369	10,672	+ 6.5	11,018
Domestic Demand	11,197	10,478	+ 6.9	10,823
Export Demand	172	193	—10.9	195
Gasoline, Total Demand	3,711	3,620	+ 2.5	3,898
Distillate, Total Demand	3,081	2,806	+ 9.8	3,000
Kerosine, Total Demand	600	479	+25.3	606
Residual, Total Demand	1,908	2,042	— 6.6	1,756
Other Oils, Total Demand	2,080	1,725	+20.6	1,758
CHANGE IN STOCKS				
All Oils, Change in Stocks	—971	—584		—1,094
NEW SUPPLY				
Total New Supply	10,398	10,088	+ 3.1	9,924
Domestic Production, Total	8,168	8,174	— 0.1	8,160
Crude Oil	7,163	7,230	— 0.9	7,145
Natural Gas Liquids	1,005	944	+ 6.5	1,015
Imports, Total	2,230	1,914	+16.5	1,764
Refined Products	1,080	991	+ 9.0	850
Crude Oil, Total	1,150	923	+24.6	914
Crude, East of California	827	753	+ 9.8	604
CRUDE RUNS				
Crude Runs to Stills	8,323	8,279	+ 0.5	8,021
Domestic Crude	7,277	7,354	— 1.1	7,053
Foreign	1,046	926	+12.9	968

U.S. Stocks of Oils (Million Bbls. at End of Month)

KIND OF OIL	TOTAL IN U.S. Jan. 1961	Jan. 1960	% Diff.	Dec. 1960	EAST OF CALIFORNIA Jan. 1961	Jan. 1960	% Diff.	Dec. 1960
All Oils	759.2	790.9	— 4.0	789.3	.....	.....	.....	.....
Crude Oil	234.9	252.2	— 6.9	238.7	204.6	218.9	— 6.5	208.7
Gasoline	211.8	206.0	+ 2.8	196.9	182.2	175.0	+ 4.1	168.9
Distillate Fuel Oil	111.8	125.9	—11.2	140.2	98.6	114.0	—13.5	127.2
Kerosine	27.4	26.5	+ 3.4	31.7	25.8	25.4	+ 1.6	30.1
Residual Fuel	44.0	49.3	—10.8	45.8	31.3	30.5	+ 2.6	32.1
Other Oils	129.3	131.0	— 1.3	136.0	.....	.....	.....	.....

U.S. Crude Production, by States (Thous. Bbls.)

STATE or DISTRICT	Daily Average in January 1961	1960	% Diff.	Dec. 1960	Total in January 1961	1960	% Diff.
Alabama	21.3	15.8	+ 34.8	21.5	659	491	+ 34.2
Arkansas	75.9	70.5	+ 7.7	74.6	2,352	2,184	+ 7.7
California	833.4	828.8	+ 0.6	836.6	25,837	25,695	+ 0.6
Colorado	131.9	127.9	+ 3.1	132.6	4,088	3,965	+ 3.1
Florida	1.0	1.4	— 28.6	0.9	29	35	— 17.1
Illinois	216.4	221.8	— 2.4	220.4	6,708	6,875	— 2.4
Indiana	33.0	32.5	+ 1.5	32.8	1,024	1,009	+ 1.5
Kansas	294.4	314.0	— 6.2	297.2	9,126	9,733	— 6.2
Kentucky	53.4	63.6	— 16.0	54.2	1,657	1,973	— 16.0
Louisiana	1,126.4	1,084.6	— 3.9	1,111.9	34,919	33,622	+ 3.8
North Louisiana	110.4	122.9	— 10.2	110.6	3,422	3,809	— 10.2
South Louisiana	1,016.0	961.7	+ 5.6	1,001.3	31,497	29,813	+ 5.6
Michigan	51.1	33.1	+ 54.4	48.4	1,583	1,027	+ 54.1
Mississippi	151.1	150.1	+ 0.7	151.5	4,684	4,651	+ 0.7
Mo.-So. Dak.-Tenn.	0.6	0.4	+ 50.0	0.6	19	11	+ 72.7
Montana	80.3	82.5	— 2.7	80.1	2,490	2,556	— 2.6
Nebraska	64.9	64.1	+ 1.2	64.9	2,011	1,987	+ 1.2
Nev.-Wash.-Alaska-Ariz.	4.4	0.8	+450.0	3.4	137	24	+470.8
New Mexico	298.0	300.7	— 0.9	298.5	9,240	9,323	— 0.9
Southeast	263.0	256.5	+ 2.5	263.3	8,154	7,953	+ 2.5
Northwest	35.0	44.2	— 20.8	35.2	1,086	1,370	— 20.7
New York-Pennsylvania	19.3	21.2	— 9.0	19.2	599	659	— 9.1
North Dakota	67.1	57.7	+ 16.3	68.6	2,080	1,789	+ 16.3
Ohio	11.6	14.0	— 17.2	11.0	359	433	— 17.1
Oklahoma	519.2	559.3	— 7.2	522.8	16,095	17,340	— 7.2
Texas	2,611.9	2,714.4	— 3.8	2,596.5	80,970	84,147	— 3.8
Dist. 1: South Central	45.8	43.0	+ 6.5	47.0	1,421	1,334	+ 6.5
Dist. 2: Middle Gulf	115.5	121.5	— 4.9	116.5	3,581	3,766	— 4.9
Dist. 3: Upper Gulf	364.0	378.2	— 3.8	361.9	11,284	11,725	— 3.8
Dist. 4: Lower Gulf	192.5	189.6	+ 1.5	191.3	5,968	5,878	+ 1.5
Dist. 5: East Central	27.4	27.4	.....	27.4	848	850	— 0.2
Dist. 6: Northeast	255.3	263.3	— 3.0	252.6	7,916	8,161	— 3.0
Dist. 7-B: North Central	126.4	135.5	— 6.7	123.6	3,917	4,200	— 6.7
Dist. 7-C: West Central	119.4	127.1	— 6.1	120.3	3,701	3,940	— 6.1
Dist. 8: West	1,065.1	1,083.6	— 1.7	1,053.4	33,019	33,593	— 1.7
Dist. 9: North	197.0	195.0	+ 1.0	200.5	6,106	6,046	+ 1.0
Dist. 10: Panhandle	103.5	109.3	— 5.3	102.1	3,209	3,389	— 5.3
Utah	109.1	110.3	— 1.1	111.0	3,383	3,420	— 1.1
Virginia	.....	.....	.....	.....	.....	1	.....
West Virginia	5.9	5.5	+ 7.3	5.6	183	167	+ 9.6
Wyoming	381.3	355.6	+ 7.2	379.8	11,819	11,023	+ 7.2
Total, U.S.	7,162.9	7,230.3	— 0.9	7,144.8	222,051	224,140	— 0.9

Sources for above 3 tables: Bureau of Mines monthly reports, except last two months based on API and B. of M. weekly reports and WORLD OIL estimates, and Texas districts from API.

Number 3 of a Series
TELL THIS PETROLEUM INDUSTRY FACT TO YOUR NEIGHBOR

Putting the squeeze to it!

The products of the petrochemical industry represent one of the great industrial achievements of our time. The polyethylene bag that protected the shirt you put on this morning is a good example. It was made from a refining by-product known as "off-gas," light ends from the refining process.

The petrochemical industry processes oil and gas hydrocarbons into raw materials for fibers, drugs, chemicals and plastics. Petro-chemistry transforms gas liquids from field processing, refinery light ends, "off-gas" and many other petroleum by-products into thousands of wondrous new materials. In our free enterprise climate the petroleum industry invests millions of dollars annually in research and development to put the squeeze to oil and gas that constantly widens the horizon of end uses for these hydrocarbons.

© COPYRIGHT 1961 BAROID DIVISION NATIONAL LEAD COMPANY

BAROID

BAROID DIVISION NATIONAL LEAD COMPANY

MAIN OFFICE: P. O. BOX 1675, HOUSTON 1, TEXAS

BAROID—*Still Pioneering Drilling Mud Research • Engineering • Marketing*

Reproduction proofs of this message are available with or without the Baroid Signature . . . Write Advertising Manager, Baroid Division

Drilling continues downward trend

By **WORLD OIL Staff**

SEVERE WINTER weather combined with excessive productive capacity to hold January new well completions 10.7 percent below the same 1960 period, and 16 percent below January 1959. During the first month of 1961, operators completed 3,641 new wells for a drop of 436 wells from the January 1960 total.

The January total also was down 468 wells or 11.2 percent from the 4,109 wells completed during December. In 1960, the January total was down 4.3 percent from December. Both of these years are in sharp contrast to January 1959 when the total of 4,334 new wells reflected a sharp increase of 375 wells or 9.5 percent over December.

Only 3,252 cable tool and rotary rigs were reported operating on January 31, down 259 rigs or 7.4 percent from December's end, and 450 rigs or 12.1 percent below January 31, 1960.

Operators drilled 15.1 million feet of hole during January, for a decrease of 3.5 million feet or 23.2 percent from December. The January total also was down 2.2 million feet or 12.7 percent from the January 1960 total of 17.3 million feet.

January wildcatting activity dropped 206 wells or 22.7 percent from the January 1960 total, to 701 wells. The January total also was down 87 wells from December.

U.S. Drilling Activity in January, 1961

STATE or DISTRICT	TOTAL NEW WELLS COMPLETED							WILDCATS COMPLETED					†Active Rigs at End of Month
	Oil	Dist.	Gas	Dry	Service	Total Wells	Total Footage	Oil	Dist.	Gas	Dry	Total	
Alabama	1	....	....	1	....	2	14,267	....	....	....	....	....	10
Alaska	1	....	1	....	....	2	16,850	....	....	....	....	....	9
Arizona	....	....	....	1	....	1	1,180	....	....	....	....	....	2
Arkansas	14	....	5	23	....	42	178,724	1	....	1	11	13	41
California	100	....	9	31	5	145	586,294	....	....	....	12	12	133
Colorado	10	1	8	34	....	53	238,536	2	....	1	28	31	44
Illinois	98	....	6	124	....	228	488,630	....	....	....	62	62	216
Indiana	29	....	....	41	....	70	103,840	1	....	....	16	17	131
Kansas	188	....	27	182	17	414	1,471,505	6	....	....	49	55	218
Kentucky	110	....	21	79	....	210	160,688	....	....	....	5	5	150
Louisiana	109	12	26	99	....	246	1,943,635	....	2	....	21	23	280
North Louisiana	33	....	19	33	....	85	285,383	....	....	....	7	7	54
South Louisiana	76	12	7	66	....	161	1,658,252	....	2	....	14	16	226
*Gulf of Mexico	24	2	3	9	....	38	410,439	....	....	....	2	2	53
Michigan	16	....	3	46	....	65	212,997	....	....	....	32	32	83
Mississippi	20	....	3	30	....	53	536,981	1	....	....	16	17	40
Missouri	....	....	....	1	....	1	1,400	....	....	....	....	....	2
Montana	17	....	....	19	....	36	180,163	1	....	....	8	9	22
Nebraska	18	....	....	46	....	64	318,639	4	....	....	36	40	30
New Mexico	75	....	37	32	....	144	776,555	3	....	....	15	18	115
Southeast	58	....	3	27	....	88	451,951	3	....	....	12	15	71
Northwest	17	....	34	5	....	56	324,604	....	....	....	3	3	44
New York	15	....	3	3	7	28	43,925	....	....	....	....	....	25
North Dakota	9	....	....	3	....	12	83,141	....	....	....	2	2	12
Ohio	45	....	13	19	....	77	205,148	....	....	....	6	6	132
Oklahoma	149	8	15	113	22	307	1,192,912	5	1	3	30	39	435
Pennsylvania	19	....	19	5	9	52	149,618	....	....	1	2	3	45
South Dakota	....	....	....	1	....	1	8,633	....	....	....	1	1	....
Tennessee	4	....	....	8	....	12	4,598	2	....	....	5	7	20
Texas	627	15	138	408	12	1,200	5,531,413	20	1	9	247	277	763
Dist. 1: South Central	31	....	4	26	....	61	198,165	....	....	1	22	23	30
Dist. 2: Middle Gulf	7	....	28	27	....	62	426,782	....	....	2	20	22	51
Dist. 3: Upper Gulf	45	15	14	47	....	121	877,530	1	1	1	37	40	91
*Gulf of Mexico	....	....	....	....	....	....	....	....	....	....	....	....	1
Dist. 4: Lower Gulf-S.W.	41	....	26	40	....	107	560,522	2	....	2	20	24	81
Dist. 5: East Central	3	....	1	8	....	12	85,087	....	....	....	6	6	15
Dist. 6: Northeast	43	....	3	22	....	68	370,967	1	....	....	12	13	26
Dist. 7-B: North Central	76	....	15	81	....	172	534,725	6	....	1	57	64	83
Dist. 7-C: West Central	23	....	1	25	....	49	245,631	2	....	....	19	21	49
Dist. 8: West	159	....	10	54	4	227	1,202,260	5	....	....	27	32	153
Dist. 9: North	121	....	9	67	6	203	533,959	2	....	1	22	25	115
Dist. 10: Panhandle	78	....	27	11	2	118	495,785	1	....	1	5	7	69
Utah	4	....	2	7	....	13	92,705	2	....	1	6	9	31
Washington	....	....	....	1	....	1	6,500	....	....	....	1	1	1
West Virginia	25	....	63	20	....	108	288,325	....	....	....	....	....	216
Wyoming	15	....	4	33	....	52	297,412	1	....	1	18	20	38
Others	....	....	....	2	....	2	4,706	....	....	....	2	2	8
Total U.S., Jan., 1961	1,718	36	403	1,412	72	3,641	15,139,920	49	4	17	631	701	3,252
Dec. 1960	1,940	47	450	1,584	88	4,109	18,689,846	64	8	23	693	788	3,511
Jan. 1960	1,918	86	360	1,659	54	4,077	17,333,814	64	8	19	816	907	3,702
Western Canada, Jan. 1961	125	....	42	76	....	243	1,451,850	....	....	....	....	....	246
Dec. 1960	111	....	24	55	....	190	1,001,480	....	....	....	....	....	181
Jan. 1960	150	....	20	71	1	242	1,361,281	....	....	....	....	....	234

* Gulf of Mexico wells are included in their respective district totals.

† Includes wells rigging up, drilling, and temporarily shut-down.

CUT CEMENTING COSTS

ADDITIVES	STRATA-CRETE 6 (Expanded Perlite plus Perlite fines)	GILSONITE	BENTONITE	POZZOLAN	HOW DOES YOUR ADDITIVE COMPARE?
SLURRY DENSITY	12.7 lbs. per gallon at 3000 psi	12 to 12.5 lbs./gal.	13.0 lbs./gal.	14.1 lbs./gal.	
BRIDGING QUALITIES	excellent; highest available in any commercial additive	fair, but requires large amount of material	none	none	
PERFORMANCE COST	low, since you get high fill-up relative to material used.	moderate to high; some fill-up advantages	low initial cost; but cost may be high to obtain performance	low initial cost; no bridging qualities may make performance cost high	
SCOURING ACTION	excellent	fair	none	none	
PERFORATING QUALITIES	excellent, non-shattering	good	fair	good	
EASE OF PLACEMENT	good	good	good	good	
INERTNESS	chemically inert	soluble in some hydrocarbons	readily attacked by corrosive waters, acids, and alkali solutions	inert	
MELTING POINT	above 1500 F	300°F plus			
COMPRESSIVE STRENGTH	good	good	good	good	
THICKENING TIME	actually extends time	will not accelerate	will accelerate under certain conditions	will not accelerate	

Strata-Crete 6 Gives More by Actual Comparison

Strata-Crete 6®

Strata Products Department
Great Lakes Carbon Corporation

Main Office: 1404 NEILS ESPERSON BLDG. • 804 TRAVIS STREET • HOUSTON 2, TEXAS

Steel

For strength
... economy
... versatility

THE SLOTS IN THIS FORGING SAVED OUR CUSTOMER SEVERAL MINUTES MACHINING TIME

The slots in the part above used to be machined. That took time and tools. It was expensive—*needlessly*.

Now, at Bethlehem's suggestion, the forged part is trimmed along the parting line, then placed in a special fixture in the trimming press where the slots are hot-broached.

The hot-broaching involved a small additional tooling cost. But, now there's no more machining . . . No more wear and tear on machine tools . . . No more waste metal. Take our customer's word for it, his savings more than make up his slightly higher tooling costs.

Our sales engineers will be happy to take a fresh look at your forgings, to talk over your ideas and problems. Perhaps they can help you cut machining costs, too. We suggest that you get in touch with our nearest sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Practical Operating Hints

These How-To-Do-It Ideas Can Save You Money

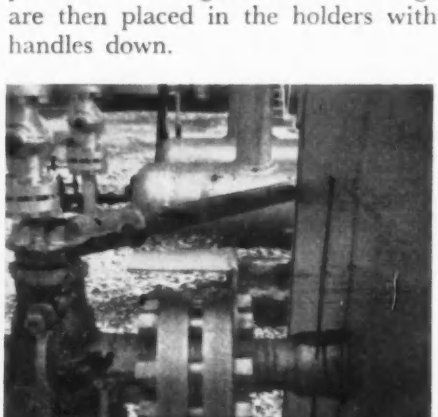
Discarded Drum Used As Disposal for Greasy Rags

This operator made an outside disposal unit for greasy rags from a discarded grease can and a length of scrap pipe. The can was fastened to the pipe on its long side and the pipe then was set in the earth as shown. Rags are placed in the open mouth container to dry. After drying, they may be laundered for re-use if desired.

Scrap Drill Pipe Used to Store Chain Tongs Safely

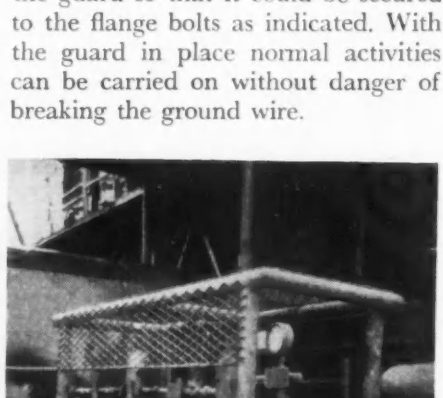
A chain tong holder may be built from scrap drill pipe and a piece of sheet metal. The drill pipe is cut into 2½-foot lengths and a piece of ¼-inch sheet metal is cut to provide run openings at evenly spaced intervals for the tongs.

The sheet metal is then welded in place at the top of the drill pipe. On the bottom is welded a similar size of plate to provide stability and a base plate for the tong holders. The tongs are then placed in the holders with handles down.



'L' Shaped Steel Guard Protects Tank Ground Wire

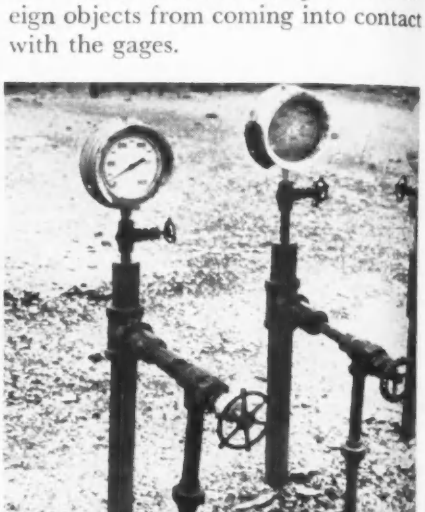
To protect the ground wire on a lease tank, the illustrated L-shaped guard was constructed from sheet steel. Holes were bored in one end of the guard so that it could be secured to the flange bolts as indicated. With the guard in place normal activities can be carried on without danger of breaking the ground wire.



Meshed Material Protects Control Equipment

Protection for the control equipment is provided by constructing a cover made of diamond-meshed material, welded to a tubular framework.

The framework is made of 2½-inch tubing which is cut and welded so as to properly cover the controls. The top, and a portion of the front, is covered with diamond-meshed material. This material is welded to the framework as shown and protects foreign objects from coming into contact with the gages.



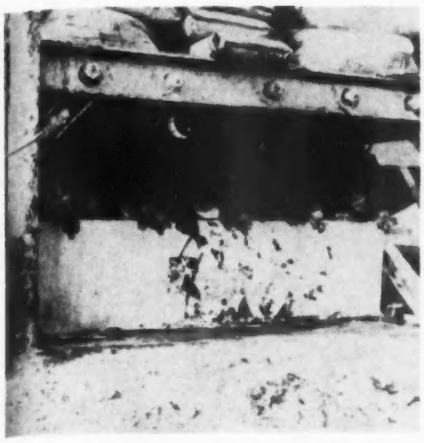
Choke Wells at Battery Makes for Better Control

This operator has installed choke valves on all flow lines leading into the tank battery. All wells are flowing at medium pressures and each has a positive choke installed in the wellhead. By adjusting the choke valve, the pumper can regulate production at the battery without having to change the positive choke in the well. Pressure gages indicate flowing well pressures.

Mount Lubricant Drums Under Work Platform

Compactness, utility and ease of transport are three things that contractors are continually trying to improve on. One contractor that had a sizable mud system was able to utilize every spare inch of space by ingenious methods. One such method of space saving is illustrated here.

The lube oil containers were mounted under the mud storage and work platform so that they were readily accessible, still they were out of the way where the trucks at loca-



tion were not always bumping into them and where they were picked up and moved with the mud platform rather than having to handle each and every drum or container separately.

A protected light is also attached overhead to facilitate using the lube drums at night and being able to read the markings on each container.

Prevent Line Movement With Simplified Anchor

To reduce line movement caused by expansion and contraction at high pressure tie-in points, one company uses the anchoring method illustrated in the photograph. An all-welded H-shaped pipe structure is embedded in a heavy concrete block astride the lines adjacent to the tie-ins. The lines are run through holes cut in a rectangular piece of ½-inch steel plate, the latter welded between the upright vertical members of the structure. The flow lines then are welded to the plate.

Such an anchor is easily pre-fabricated in the shop for later installation in the field. It need not be disturbed should lines have to be taken up or replaced since the plate can be cut out and another welded in its place.

SEAL SECURELY··

with the...

oilmaster

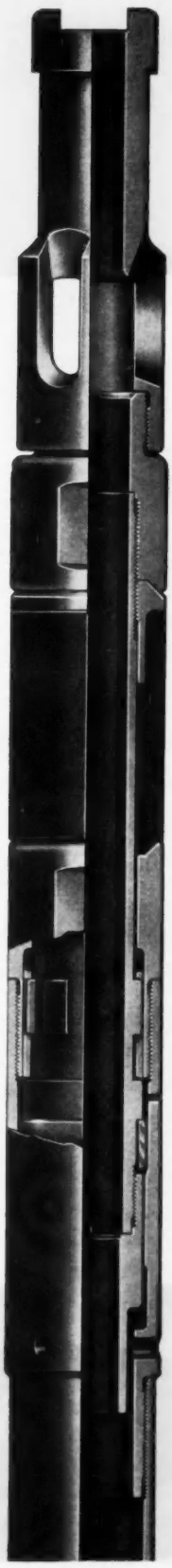
AUTOMATIC

Top Seal

A stationary barrel bottom anchored pump **CAN** be run safely in sandy wells . . . when coupled with an **OILMASTER Automatic Top Seal.** The Top Seal eliminates the hazard of stripping jobs by effectively sealing the annulus between the pump and tubing. It also reduces pull rod wear by stabilizing and centering the top of the pump.

OILMASTER's Top Seal is fully automatic . . . it requires no special actuation to set or pull. When the pump is seated, the weight of the rods expands the rubber against the tubing, sealing out sand and foreign material. When the pump is pulled, large ports allow fluid to drain rapidly past the Top Seal and the controlled expansion rubber is pulled intact with the pump.

Ask your **OILMASTER** or **National Supply** representative to demonstrate the advantages and economies of the **Automatic Top Seal,** or contact these co-distributors: **Beacon Supply Company, Dominion Oilfields Supply Company, Limited, Industrial Supply Company, Union Supply Company. For literature write to FLUID PACKED PUMP, 9100 S. Norwalk Blvd., Los Nietos, Calif., and ask for Bulletin 6101.**



Large ports insure rapid fluid by-pass.

Positive seal against sand and foreign matter.

Metal sleeve molded to rubber assures positive removal of seal with pump.

Anti-swivel splines clutch pump to rod string.

Plunger bump cannot release rubber.

ARMCO

National Supply Division

For more data on advertised products, use Readers' Service Cards, last page.

Another Step In Gray Quality Control . . .

ENGINEERING DESIGN

From drawing board to well head installation, good, basic engineering design is built into every Gray Well Head Control Assembly component. Gray's Engineering standards require practical application of such engineering precepts as more strength, less weight; reduction of areas subject to pressure; elimination of unnecessary parts. Gray has done this, and combined it with flexibility to efficiently handle every well control problem in whatever pay zone you are working — deep or shallow, single or multiple.

For additional information about why Gray Engineering Design is another step forward in advanced quality control, write today for your copy of the new Gray Catalog.

GRAY *Tool Company*

6001

P. O. BOX 2291 HOUSTON 1, TEXAS Riverside 7-1240

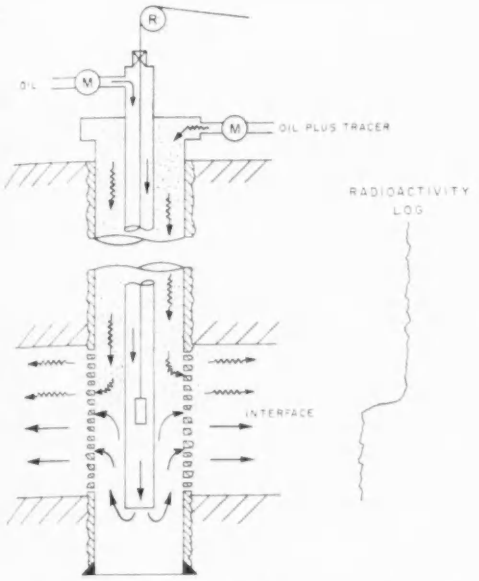


FIGURE 1—Open ended tubing is positioned at or below bottom of the zone of interest. Both annulus and tubing streams are metered and one is tagged with a radioactive tracer. A radioactivity detector, suspended in the tubing, traverses the formation and determines depth location of the radioactive-nonradioactive interface.

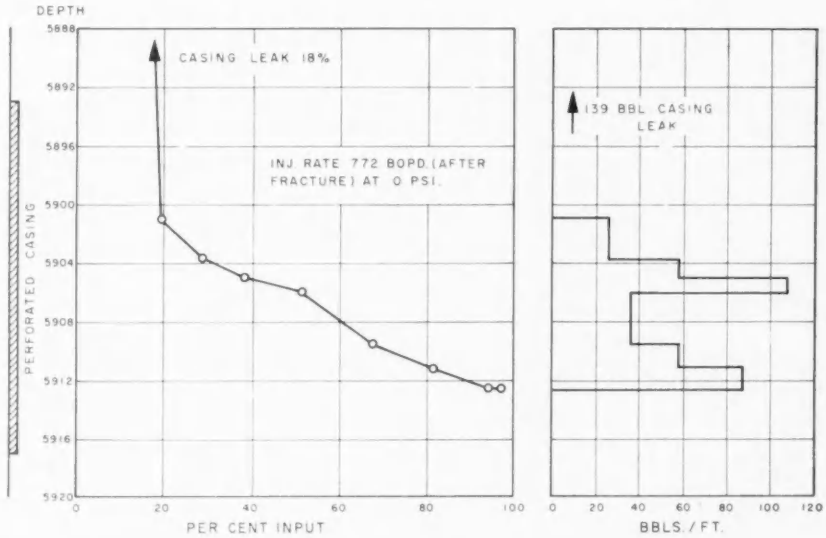


FIGURE 2—It was not possible to perform an injectivity survey on this South Oklahoma well prior to fracturing because of high breakdown pressure. Surveys following fracturing indicated fair receptivity over 57 percent of the perforated interval. However, during the course of the survey a casing leak was indicated at some distance above the perforations. Two methods of data presentation are shown.

Oil injectivity surveys evaluate well remedial work

Technique determines effectiveness of stimulation treatments, perforating jobs, sand consolidation work, squeeze cementing operations

By Richard H. Widmyer
Research Petroleum Engineer
Texaco Inc., Bellaire, Texas

OIL INJECTIVITY surveys are used to evaluate all types of remedial work performed on a well. The effectiveness of fracturing, acidizing, sand consolidation work, perforating and squeeze cementing can be determined, as well as the presence of casing leaks, leaks around the casing shoe and the location of plugged perforations or liners. Channeling behind casings has been observed and the thief zone located by observing the radioactivity buildup in addition to determining the rate of loss. This article describes field experience with oil injectivity profile logging.

In recent years, many wells have been subjected to various stimulation treatments in an effort to increase production and reservoir recovery. The need for a method to determine type of treatment required and to evaluate the treatment after it has been performed has become apparent. An increase in production does not necessarily mean that optimum results have been obtained.

Injectivity profile logging has been used successfully to determine intervals of fluid entry in water input and gas injection wells. This technique has been described in detail in previous literature.[1, 2] Now, injectivity profile logging has been used to determine the permeable or producible intervals of producing wells.

The technique utilizes a slightly radioactive solution to identify one of two injection streams entering a well. Fluid in one of the injection streams, the annulus, approaches the zone of interest from the top moving downward. Fluid in the other stream approaches from the bottom moving upward by means of open ended tubing positioned below the zone of interest. A conventional radioactivity detector is run in the tubing to determine location of the interface at which the radioactive-nonradioactive streams meet in the annulus (Figure 1). Thus, annulus injection fluid enters the formation above the interface and tubing fluid enters the formation below the interface.

Total input rate is held constant, and the percentage injection into tubing and annulus is systematically varied while recording the depth at which each resultant interface occurs. The depth difference between two interfaces is the interval receptive to a fluid volume equal to the percentage difference for the corresponding

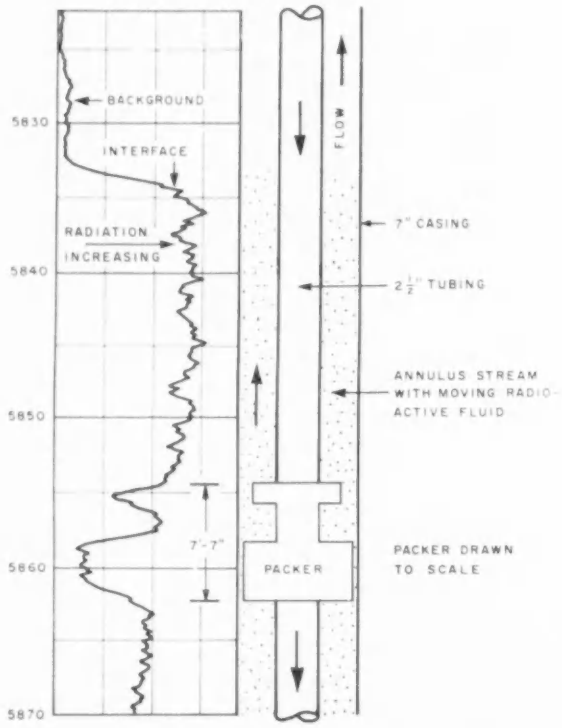


FIGURE 3—While searching for the casing leak of the well shown in Figure 2, the interface moved up past an unseated packer hanging free in the well. In logging this section, the excellent discriminating ability inherent in the technique is illustrated both by the outline of the packer and the sharpness of the moving interface. The exact length of the packer, 7.7 feet, is indicated as well as an almost perfect profile of the packer. This is an example of the reliability with which interfaces, casing shoes and other anomalies can be located in the wellbore.

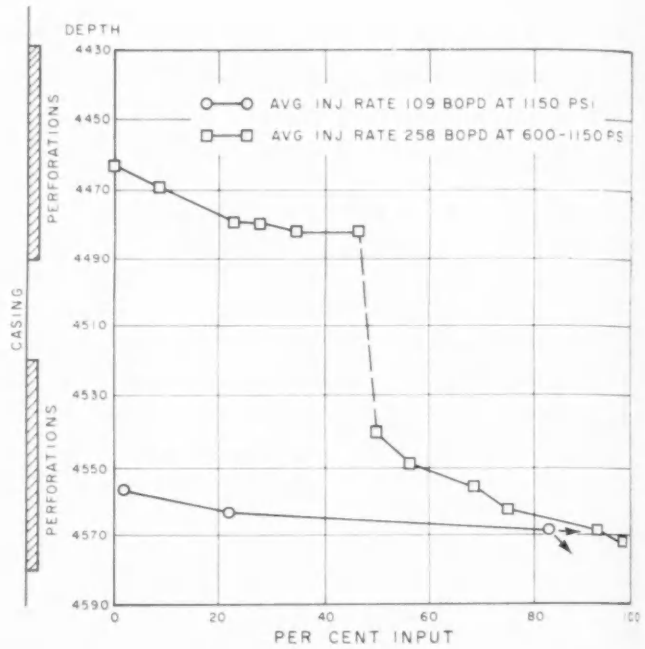


FIGURE 4—Oil injectivity surveys were conducted on this newly completed West Texas well before and after fracturing. Prior to fracturing only a short lower interval (10 percent of total perforations) was permeable to oil injection. Following simultaneous fracturing of both sets of perforations, injection pressure was reduced and each perforated interval took approximately 50 percent of the oil injected with 38 percent of the upper perforations being receptive.

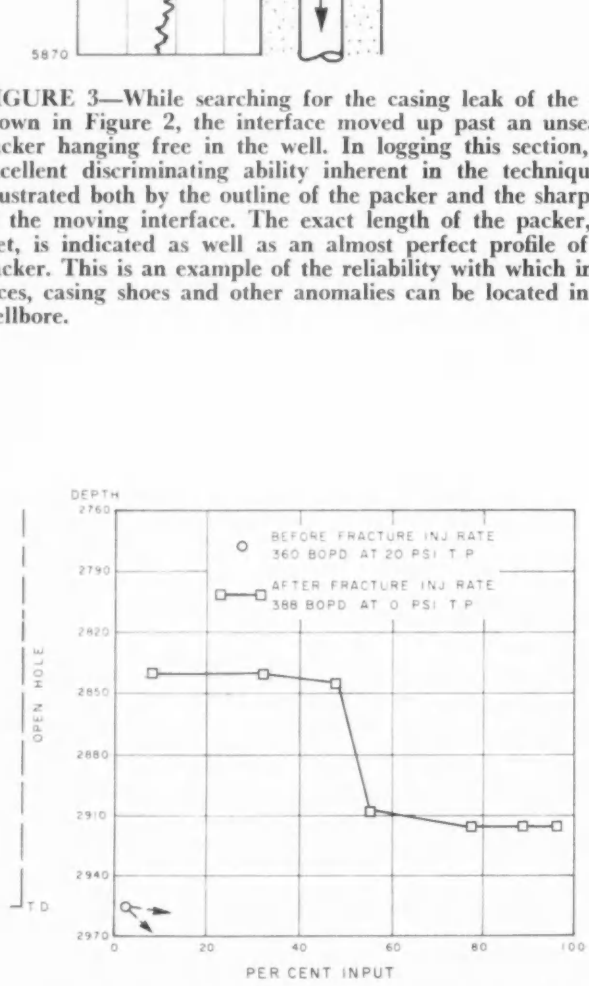


FIGURE 5—This West Texas open hole completion was surveyed before and after fracturing. Before fracturing all of the oil was found to be going out the bottom of the hole. From the survey following fracturing, it was revealed that oil injection was confined to a lower 8 foot interval and the 4.5 foot interval near the middle of the open hole. Each was taking approximately 50 percent of the oil injected. Although this well subsequently produced top allowable, the fracturing treatment cannot be considered truly successful since less than 6 percent of the intended completion interval was receptive.

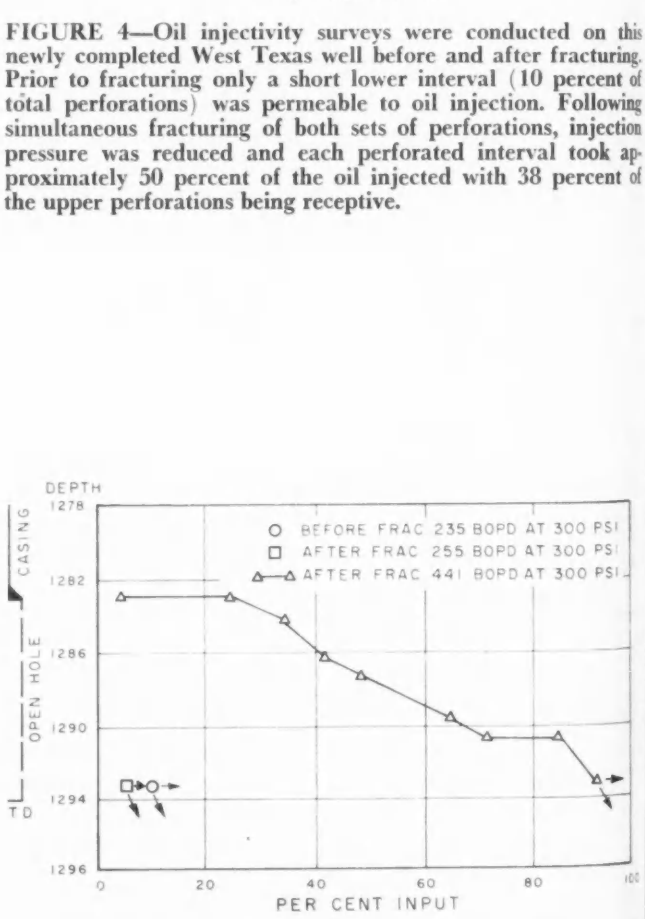


FIGURE 6—The oil injectivity survey conducted prior to fracturing this South Texas well shows that all of the oil was entering the formation at the hole bottom as it did at a comparable rate and pressure following fracturing. However, subsequent surveying at increased rate and pressure resulted in approximately 80 percent of the injected oil being uniformly injected over the whole open-hole interval, thus indicating the formation to be rate and pressure sensitive.

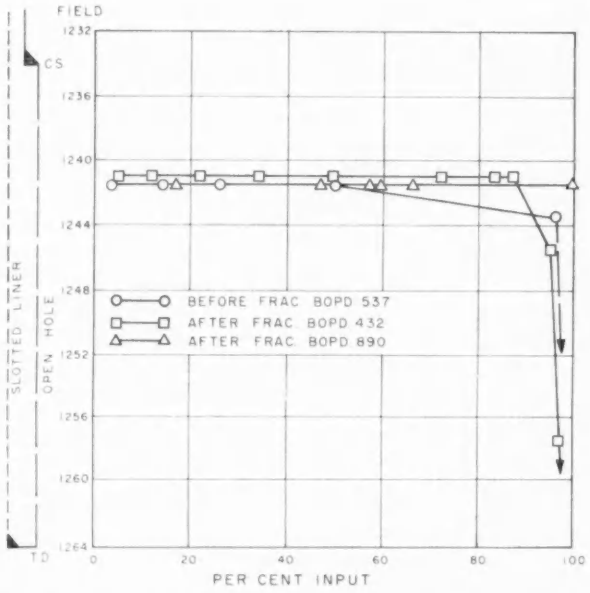


FIGURE 7—Oil injectivity surveys of this South Texas well were conducted before and after fracturing at both comparable and increased rates. From 90 percent to 100 percent of the injected oil was found to be leaving the liner in one short interval. This indicated that the formation was not rate sensitive and that the fracture treatment used did not open any additional intervals, although production increased fourfold. Although surveys were conducted at injection rates several times larger than the production rate, it is obvious that no additional interval would be receptive to oil at a lesser injection rate.

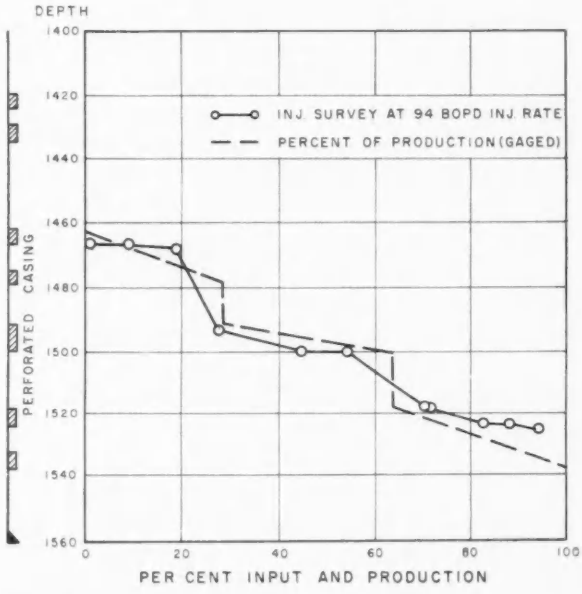


FIGURE 8—This North Louisiana well was surveyed to determine if the technique could be used to replace time consuming separate testing of the completed intervals. Straddle packers were used to isolate the intervals shown during testing. Plotting production in percent of cumulative production shows excellent agreement with the oil injectivity survey.

tubing or casing rates. Two methods of presenting the injection profile are shown in Figure 2.

There is an important difference between the aforementioned water and gas injectivity surveys and oil injectivity surveys. With water and gas, the greatest utility of the technique has been for determination of the injectivity profile of wells normally used for injection of a fluid as part of a field development program. Using oil, injectivity profiles are determined for producing wells.

Efforts have been made to (1) use an injection oil native to the formation, (2) maintain downhole injection pressure differential comparable to production pressure differential and (3) have injection rate approach production rate. Even when these factors are different, the technique has considerable utility in determination of nonreceptive yet potentially productive sections of the completed interval. It is these zones that are the focus of subsequent remedial work to increase production. Also, injectivity surveys conducted at appropriate rates before and after a stimulation treatment will aid in evaluating the treatment effectiveness.

Some formations are rate sensitive while others are not (injectivity profile may change with injection rate and pressure). Thus, survey conditions should be selected which are commensurate with those to be evaluated. In some cases, correlations have been made between the oil injectivity profile and the well's production profile. It is anticipated that further experience will show that in most cases the injectivity technique can be used to determine the productivity profile.

Figures 2 through 8 are examples of oil injectivity surveys conducted under various conditions in several different fields. Figure 3 illustrates the accuracy with which the radioactive interface can be located. Figure 8 shows agreement between oil injectivity surveys and a zonal production gage of the well.

In some examples, the fracturing technique was shown to be very effective in opening up the desired interval. In others, fracturing provided little or no additional permeable intervals. Almost all fracturing treatments resulted in increased production. However, where only a small percent of the total available interval is rendered permeable, the fracturing cannot be considered truly successful when a large production potential still remains unavailable. In one case, a casing leak was found to exist.

Application of oil injectivity survey techniques, together with subsequent remedial work where indicated, should result in more efficient production and increased recovery.

About the Author

Richard H. Widmyer was graduated from Ohio State University in 1949 with a B.S. degree in mining engineering, petroleum option. He has worked for Texaco Inc. since 1949, as a field, reservoir and research petroleum engineer. He is presently a research petroleum engineer engaged in log interpretation and evaluation, and in well stimulation work in the Bellaire (Texas) laboratory of the Research and Technical Department.

ACKNOWLEDGMENT

The author wishes to express his appreciation to the management of Texaco Inc. for permission to publish this report, to his co-workers R. C. Reynolds and W. R. McEvers and to the field personnel whose cooperation made this work possible.

LITERATURE CITED

[1] A. S. McKay and E. F. Egan, "New Method Simplifies Injectivity Profile Logging," World Oil, March, 1955.

[2] R. H. Widmyer, "Gas Injectivity Profile Logging Is Successful," World Oil, September, 1958.

New radio reflection method finds oil and gas directly

Fluid contacts evidently reflect radio energy. Field tests indicate high accuracy.

By Harrison T. Brundage, Exploration Editor, WORLD OIL

NEWLY DEVELOPED and field tested radio wave reflection techniques have been proved as valuable aids in locating prospective oil, gas, and gas-condensate deposits. Radio wave reflection field procedures and interpretive techniques not only assist in establishing boundaries of undrilled oil and gas accumulations but also can provide satisfactory depth measurements, even in multiple-pay situations. Recent drilling has borne out predictions based on this means of exploratory field work.

Related methods previously described in the technical literature have dwelt on field intensity profiles indicative of the *probable lateral extent of known productive trends.*

How it works. Field equipment includes a specially designed radio frequency transmitter which emphasizes stability of both power output and frequency, installed in a light house trailer; and the receiver, mounted on a light semi-amphibious vehicle equipped with battery and power supplies.

The output system is so adjusted as to match the characteristic impedance of the ground, thus allowing loading of the ground and ready transfer of radio energy into the subsurface.

Due to characteristically high impedance of free air, and because the transmitter is adjusted so as to offer a match for the characteristically low impedance of the ground, relatively little radio frequency energy is transferred from this arrangement into the free air.

The abrupt differences between the electrical characteristics of hydrocarbons and salt water provide the only real distinction between an oil and/or gas accumulation and other natural occurrences in a sedimentary section (e.g., ground water, mineralized veins, etc.). This strong difference is utilized in interpretation of electrical log resistivity curves to determine oil and gas saturations and fluid contacts. Permeability may be inferred, if not actually measured, from such logs; an abrupt drop in resistivity values at the oil-water or gas-water contact indicates high permeability; a more

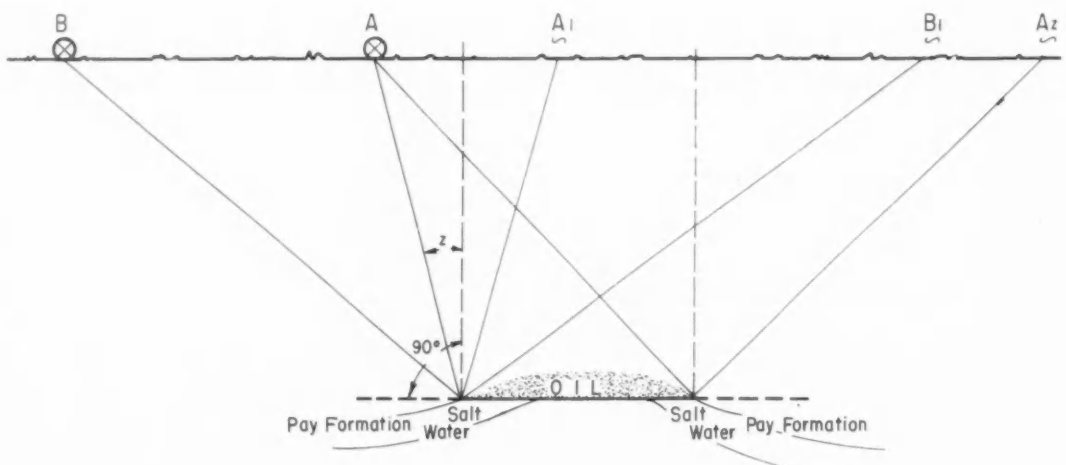
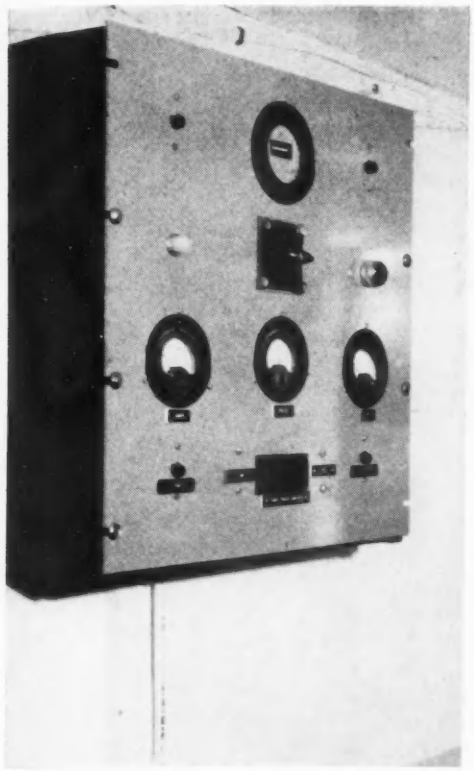
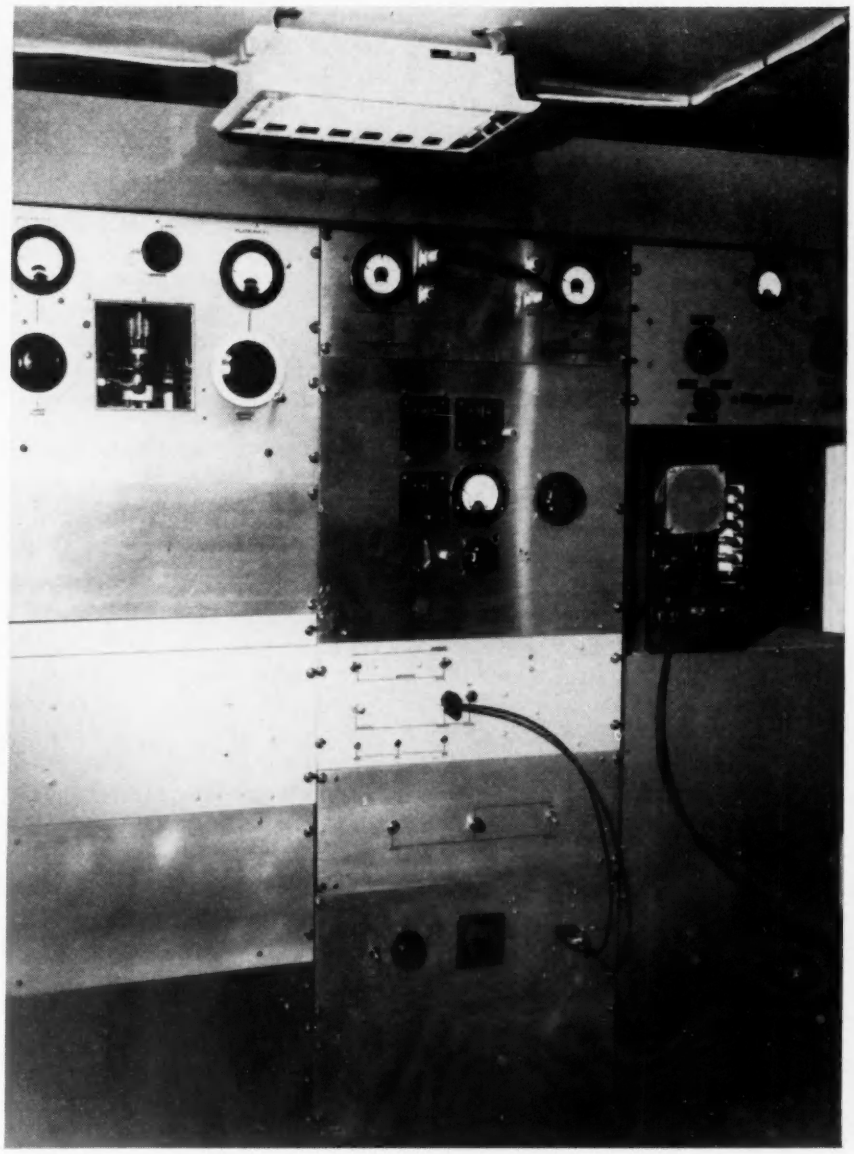


FIGURE 1—Radio energy loaded into the subsurface is evidently reflected by a hydrocarbon deposit because of the electrochemical difference between hydrocarbons and salt water. This electrochemical difference is more pronounced at the edges (lateral fluid contacts) than at the center, hence limits of undrilled oil and gas fields can be determined with high accuracy in advance by this method. As the transmitter (at point A) nears the area vertically overlying the anomaly, the anomaly as read from reflected radio energy at receiver at A_1 appears to approach the transmitter. As the transmitter (moved to point B) is moved away from the anomaly, the anomaly as read from reflected radio energy at receiver at point B_1 appears to move away from the transmitter. Critical angle z is proportional to phase relationships of returned radio energy and may thence be determined to help compute the depth of the anomaly.





FIGURES 2 and 3—This radio transmission equipment is installed in adjoining wall panels of a small house trailer. In field practice the antenna is connected with the trailer via a long cable to enable the operators to move the point of ground-loading readily and thus to minimize movement of the transmitter trailer.

gradual or irregular resistivity decline curve infers lower permeability.

In addition to the ability of the radio reflection (or electromagnetic) method to detect oil and gas accumulations, this technique has a further aim of indicating pay zone porosities.

In the field, several straight-line traverses are run across a prospective area. Readings along such traverses may be as widely spaced or as detailed as conditions require. In field work conducted to date, minimum spacing of readings has been at 100-foot intervals. Readings at 50-foot intervals may be readily done to provide more detailed coverage.

Radio energy is evidently reflected at the oil- or gas-water contacts and measurable amounts of it are returned to the surface and recorded.

On the other hand, in barren areas the radio wave energy simply attenuates, and a diminished energy return curve is developed as the distance of the receiver from the transmitter is increased.

Localizing the anomaly. Once a hydrocarbon accumulation is indicated, the surface area vertically overlying its specific boundaries may be determined from computations or from graphic diagramming of the radio wave response data. As the transmitter is moved away from the anomaly, the anomaly appears to move away from the transmitter; and as the transmitter is moved toward the anomaly, the anomaly appears to approach the transmitter. This experience indicates that the radio energy (or related phenomena) is achieving penetration.

The magnitude of the shift is proportional to the depth. Depths may be estimated accurately via normal right triangle trigonometry because the critical angle is found to be proportional to phase relationships of the returned radio frequency energy.

This technique evidently reads the electrochemical difference between hydrocarbons and the salt water backup in prospective pay formations. There is a radical, strong electrical as well as chemical difference between hydrocarbons and salt water.

The following theoretical aspects appear to be borne out by field experience. The radio frequency energy, being essentially high-frequency alternating current, is apparently rectified in part upon reaching such an accumulation due to the electrochemical difference. Free electrons thus released in this polarized media apparently form a surface barrier which effectively reflects the remaining portion of the radio frequency. This effect is

more pronounced at the edges of the accumulation than at the center.

Velocity problems have not been evident thus far. Some radio frequencies traverse rock more readily than others. Different types of rock evidently transmit radio energy with velocity factors ranging from about 0.5 to 1 times the speed of light. Since in this method, depth estimates are not based on velocity, they are not directly affected by it.

Stratigraphic trap oil and gas accumulations can be detected just as readily as structural ones, since the method depends on the hydrocarbon-salt water contrast, irrespective of structural and stratigraphic conditions.

Depth accuracy. Depending on how detailed the survey is, depths can be estimated satisfactorily. A rough survey can yield computations within 1,000 feet of true depth; a detailed survey can yield results within 100 feet of depth above 7,000 feet and probably within 500 feet in cases of deeper accumulations. This depends also on the magnitude of possible overlying bituminous shale beds and shallow oil accumulations which may tend to blanket the area without any pronounced fluid contacts being discernible.

Lithology has no evident effect on this method, which works equally well in limestone as in sand-shale country. There is little, if any, limit to the depths that can be penetrated. It has been used to predict pays down to 13,500 feet. It should be sufficiently accurate to any drillable depth.

Fluid contacts. Gas-water contacts have characteristics which are distinguishable from oil-water contacts as read from the data; hence, it may be possible to predict with reasonable accuracy whether an accumulation is primarily gas or oil, or even to distinguish in advance between a high API gravity oil or gas-condensate deposit and a heavier oil accumulation.

Regarding topography, only the most extreme type would have any effect on this method. Varying soil conditions have little or no effect on it.

Possible future adaptations. Limited research to date indicates the probable feasibility of offshore exploration using this method. It may also be possible to make successful low-level airborne adaptations of the electromagnetic method for reconnaissance purposes.

Speed of operation on the ground varies greatly, depending on the type of surface. In marsh areas (e.g., south Louisiana) ten acres a day would be good coverage. In more accessible dry areas, about 100 acres daily would be considered an average rate.

Limitations. A blanket-type shallow oil, gas, tar, or highly bituminous shale formation would complicate interpretation. A thick regional bituminous shale particularly complicates interpretation of deeper beds since oil-water geochemical relationships in the shale may be expected to affect propagation of radio energy. Such a formation may cause refraction of such energy.

The presence of multiple pays makes for complicated data, but in such cases multiple pays have been correctly interpreted as to their presence and approximate depths prior to confirmation by drilling. An ini-

Recent Case Histories With the Radio Reflection Technique

• An undrilled area in Matagorda County, Texas, was surveyed prior to drilling of a deep wildcat test by a large company. The electromagnetic survey indicated the likelihood of three pay zones between 11,000 and 12,500 feet, and a shallow show at about 2,000 feet.

The deep test was subsequently drilled and completed as a discovery from multiple gas-condensate Frio sands within the predicted deep interval. A minor show was also found at 2,300 feet and cased off.

• In a survey of a wildcat prospect near El Campo in Wharton County, Texas, a producer was predicted with the likelihood of gas or high API gravity oil at about 8,000 feet. Several rather narrow productive bands were indicated by the electromagnetic survey.

The first test, drilled in accordance with the electromagnetic survey, found 47° API condensate and some gas at 8,200 feet.

The next two locations were drilled in nearby areas indicated by the radio reflection method to be barren; this too was confirmed.

A fourth test, predicted by radio reflection work to be productive, was also borne out. This prospect proved to be complexly faulted.

• Three wildcats were staked in a shallow (1,800 feet) gas area in the El Campo, Wharton County area. The shallow pay sand is characteristically erratic, shaling out in an irregular manner. All three locations were predicted to be shallow gas producers, and all three found gas as predicted at about 1,800 feet. Two of the producers proved to be non-commercial.

• An independent oil company expected to drill a prospect in Chambers County, Texas, in an area peppered with dry holes indicating failure of other exploratory methods to find the accumulation. Although the depth computation technique had not developed at the time, the new location was predicted as a producer. Eight feet of productive gas sand was found at 7,600 feet.

• Another independent oil company was advised to expect a good oil show at 7,000 feet at a wildcat location permitted for drilling in Chambers County. About 25 feet of oil sand was found at about 6,500 feet.

• An operator drilling a shallow test in Wharton County was advised to expect a show at 2,000 feet, but that the commercial possibilities of the show were very slight. The well was drilled, the show was found at 2,000 feet, and the well was abandoned as anticipated.

• On four separate proposed wildcats, the operators were advised that the wells would be dry. They were.

FIGURE 4—Owens Exploration Company personnel are shown preparing to get radio reflection survey under way in a salt dome oil field in the Texas Gulf Coast. In addition to the purely exploratory aspects of this method, such surveys are extremely useful to check risky locations on the flanks of these complex, treacherous domes. The generator, installed in the small two-wheel trailer is being used to charge batteries used in the receiver equipment which was mounted on a marsh buggy in this case. William Owens, developer of the radio reflection system, readies the marsh buggy. Behind the antenna and generator trailer in the left foreground is the house trailer containing transmitter equipment. At the right, a transit used to survey traverse lines is being carried farther back along the road. Note pumping oil well at extreme right (arrow).

tial survey may be made, and followed up with more detailed coverage if a multi-pay situation is indicated, thus reducing the influence of variables involved by introducing more detailed data.

Of course, the radio reflection method cannot guarantee that any particular hydrocarbon accumulation will produce a profit or even a payout. However, the larger and/or multiple-pay deposits can ordinarily be distinguished from the smaller single ones.

Previous experience with this method has been almost entirely without benefit of any other exploratory data, since it has been essential to prove the technique without recourse to any other advance supporting data. Future applications of radio reflection to oil and gas exploration and development will undoubtedly be coordinated with sub-surface geology and other supporting data in the future.

ACKNOWLEDGMENT

Although theoretical aspects of this article may not be conclusively proven at this time, this article is published with emphasis on field experience to date to stimulate interest in more rapid development of this technique.

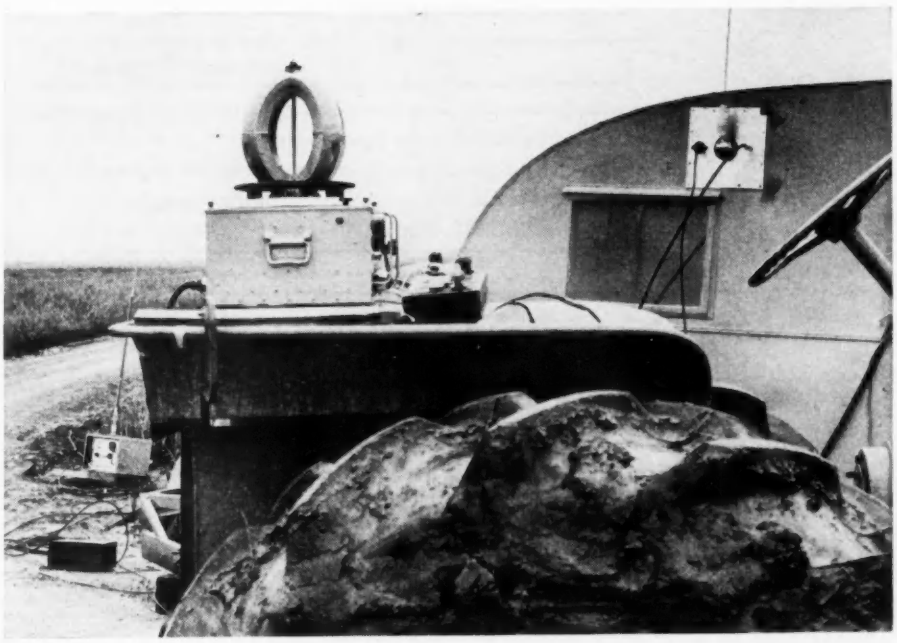


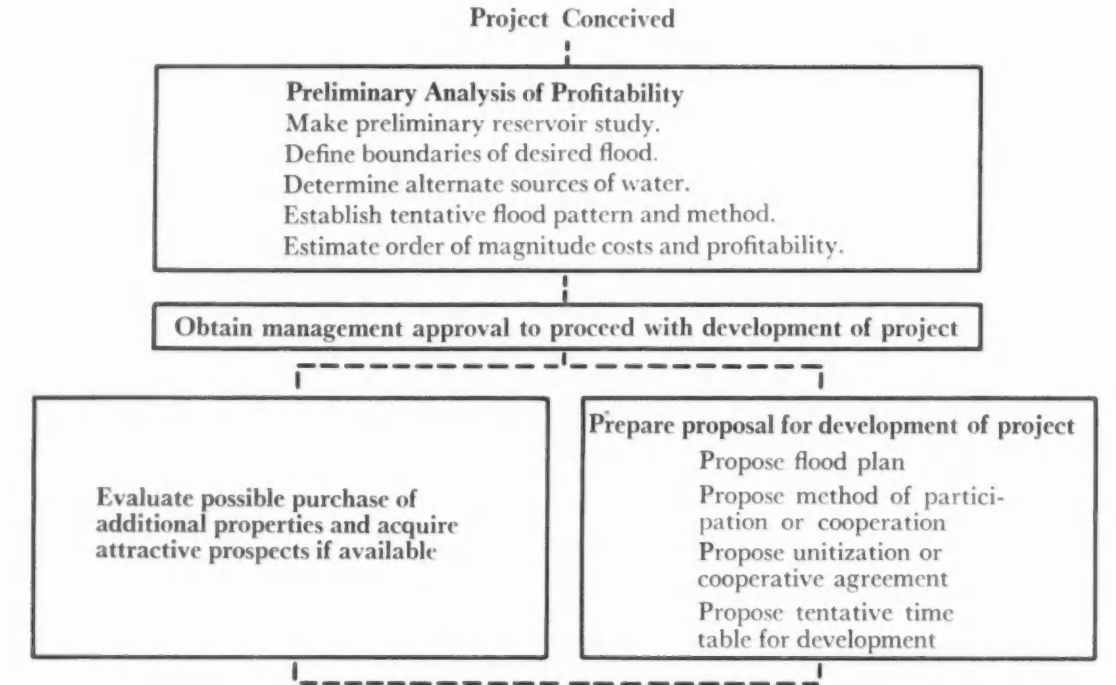
FIGURE 5—Receiver vehicle, in this case a marsh buggy, set up with the receiver for reflected radio energy (instrument capped by azimuth indicator) in the rear, and more conventional radio to permit constant communication between the receiver vehicle and the transmitter trailer.

How to start a waterflood

By L. J. Hays, Jr., Vice President
Secondary Recovery Engineering Corporation
Oklahoma City

COMPLETE PLANNING is essential if maximum profit is to be obtained from a waterflood project. Although mechanical layout of the operation is a prime consideration, initial planning is equally important. Sound scheduling of all operations will result in maximum return on investment in the shortest possible time.

The check list presented below outlines steps which should be considered prior to installing a flood. The schedule allows various operations to proceed concurrently, thus assuring rapid completion of all work involved at minimum cost. Although each installation must be evaluated individually, over-all procedures are essentially the same.


Project Conceived
Preliminary Analysis of Profitability
Make preliminary reservoir study.
Define boundaries of desired flood.
Determine alternate sources of water.
Establish tentative flood pattern and method.
Estimate order of magnitude costs and profitability.
Obtain management approval to proceed with development of project
Evaluate possible purchase of additional properties and acquire attractive prospects if available
Prepare proposal for development of project
Propose flood plan
Propose method of participation or cooperation
Propose unitization or cooperative agreement
Propose tentative time table for development
Distribute report to management of all interested operators for approval
Select operator of project
Establish firm flood plan—
Finalize unitization or cooperative agreement and execute—
Obtain any monetary authority required—
Establish firm development time table—
Evaluate sources of water—
Prepare specification of design requirements—
Secure royalty approval—
Review titles, obtain permits, easements, etc.—
Plan details of unit operation and disposition of equipment—
Plan drilling, reconditioning, etc.—
Assume operation of unit if unitized
Prepare construction plans and specifications—
Prepare firm estimate of costs and obtain A.F.E.—
Evaluate prospective bidders
Solicit bids, award contracts and construct facilities required
Complete drilling, reconditioning, etc.
Initiate water injection

How to use foaming agents in air and gas drilling

These agents aid in:

- Decreasing borehole pressure
- Increasing penetration rate in presence of water
- Preventing balling of cuttings
- Removing cuttings

By W. C. Goins, Jr.
Gulf Research & Development Co., Pittsburgh, Pa.

H. J. Magner, Vice President
Delta Drilling Co., Pittsburgh, Pa.

SURFACE-ACTIVE AGENTS or foaming agents are used effectively to prevent balling and aid in water and cuttings removal. This practice has extended the benefits of air drilling to many areas and hole intervals where air drilling was previously impractical.

At first, there was no explanation for the tremendous increases in drilling rates with air and gas, and it appeared that the principal benefit was due to some inherent property of dry gas as compared to liquid drilling fluids. Therefore, the first attempts to solve the water problem were directed at completely sealing the producing section. Various plastics, water gels,[1] portland cement, and water-reactive gases[2] were tried with some degree of success and are still used to decrease excessive water flows; but difficulty occurred in obtaining completely dry holes.

It is now recognized that penetration rate is adversely affected by the fluid column pressure; and, if excessive water column can be prevented so as to maintain low pressure in the borehole, drilling rates approaching those of gas drilling can be attained in the presence of water.

Effects of fluid column pressure on drilling rate. To illustrate the effects of fluid column pressure on drilling rate, Figure 1 was taken from the work of Cunningham and Eenink.[3] This is typical of results of investigators[4, 5, 6] who have made microbit studies of the effects of bottom hole pressures on drilling rate. In Figure 1 differential pressure is the difference between the fluid column pressure and pore fluid pressure while using drilling mud. Similar curves result when microbit drilling very low permeability formations using air, water or mud; but in this instance, pore pressure control is questionable or impossible and the drilling rate is often considered a function of the fluid column pressure alone. Shales are more pressure sensitive than the harder rock materials, but it seems certain that nearly all sedimentary materials are affected to a significant degree.

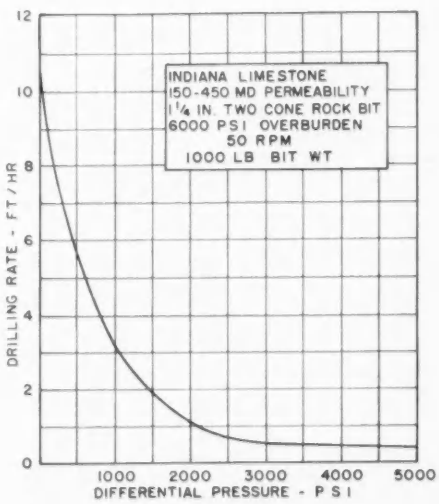


FIGURE 1—Effect of different pressure on drill rate.

There is an exception when fairly permeable formations are drilled with clean, non-filter cake producing fluids such as gas or water, as there does not appear to be any significant pressure effect. However, the amount of actual field drilling possible under these conditions is small.

Of added interest is the fact that variations of overburden or geostatic pressure show practically no effects on drilling rate; and under low pressure conditions Eckel[5] could find no difference in drilling rate with air and water, indicating that water is detrimental only as it affects fluid column pressure or when present in small quantities causing plastering.

As these results seem to be amply substantiated by field data, it is evident that for maximum drilling rate the fluid column pressure should always be kept as low as possible, consistent with other drilling require-

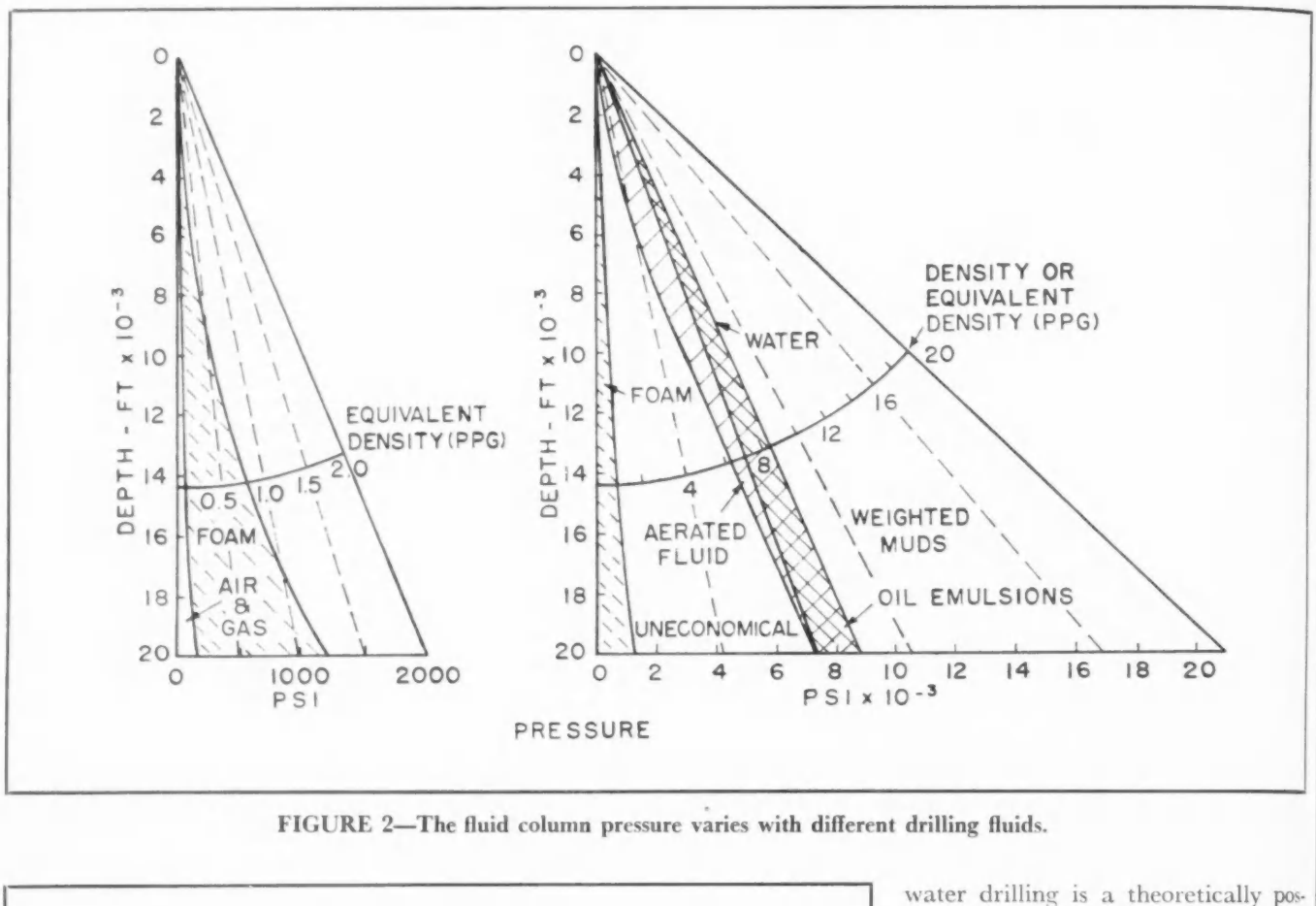


FIGURE 2—The fluid column pressure varies with different drilling fluids.

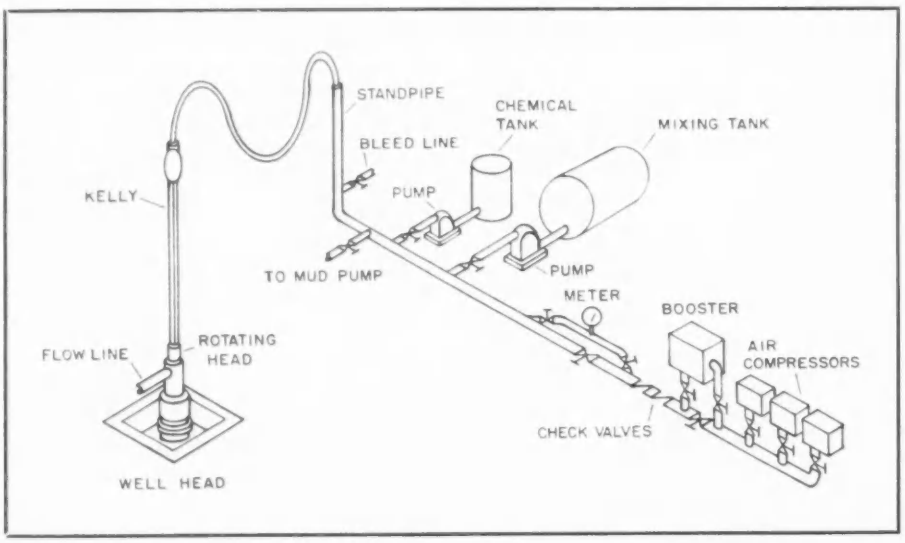


FIGURE 3—A typical circulating system used in foam drilling.

ments; and both air and foam drilling offer much in this respect.

Fluid column pressures in drilling. Figure 2 is presented to show approximately the range of drilling fluid densities possible and the resulting variation of fluid column pressure with depth. With air drilling, very low densities on the order of 0.015 pounds per gallon or less are possible although the fluid column is weighted with cuttings. When foam or mist drilling techniques are used, both cuttings and water weight the column so that there is greater fluid density and pressure with depth; still, the pressure is low compared to conventional fluids. Aerated mud or aerated water drilling[7] is the injection of air into a circulated liquid drilling fluid for purposes of lightening density. This is effective at shallow depths; but deeper, the fluid density approaches that of the liquid without air. Intermediate to mist and aerated water drilling is a theoretically possible region as yet uneconomical.

By use of oil emulsified into drilling mud it is possible to produce densities less than that of water but not less than about 7 pounds per gallon; and, of course, weighted muds have been used with densities exceeding 20 pounds per gallon.

Advantages of foam or mist drilling in terms of low fluid column pressure are substantial when compared with conventional drilling fluids.

Circulating system. The circulating system used in foam drilling is shown schematically in Figure 3. The compressors, sometimes with booster compressors, furnish high pressure air. The chemicals used are injected into the air stream prior to air entering the drill string. Water with corrosion inhibitor and foaming agents are often injected separately, or all the chemicals and water may be premixed and pumped as a single solution.

After passing the bit the air-water-chemical mixture flows up the annulus, contacting and lifting the formation water. The mixture is diverted at the surface by a drilling-head assembly into a blow line leading

away from the well. The discharge is into a pit large enough to trap cuttings, liquid foam and nearly all the settling mist. This is necessary to prevent the contamination of streams with the chemicals used.

Types of foam-producing chemical agents. At low water flow rates of approximately two barrels per hour or less, dry calcium or zinc stearate is sometimes injected; and these have been found to be effective[8] as separation agents, keeping the moist cuttings from adhering. About 0.6 pound is required per foot of hole, and it is necessary to use special equipment[8] capable of injecting powdered solids.

Drying agents also are used with low water flow rates as both driers and separation agents. Finely divided silica has seen the most use, and also has a value in the final stages of drying up a water-filled hole prior to beginning dry gas drilling.

With the powdered solids agents, there frequently is a problem of injection equipment availability, and a simple answer is to inject enough water to disperse cuttings along with foaming agents to effectively remove the water. This method of handling low water rates has been adopted in the Appalachian area to the exclusion of use of solid materials.

If it were economically feasible to do so, almost any water flow rate above the amount necessary for cuttings dispersion probably could be handled by providing sufficient volume of high pressure air. However, this is an inefficient process, and experience has shown that surface-active chemicals capable of causing water to foam promote the rate of water removal greatly.

The term "foam producing agents" is useful as is "foam drilling" because all the agents used will produce foam when air is slowly bubbled through a water solution, as in a standard foam production test. However, such tests do not necessarily indicate the relative performance of agents in wells where the conditions are quite different. If comparable conditions existed in the well, there would be a column of aerated water, and the foam rising from the water surface would remove water; but cuttings would not be lifted from the hole. In foam drilling, there first must be an air circulation rate giving a dry air discharge velocity around 3,000 feet per minute as based on atmospheric pressure. When water flows into such a stream there is a tendency to form slugs of water and air, mists, and two-phase annular flow rings. Conditions observed at the blow line indicate that all three conditions occur at different times.

When air circulation is resumed in foam drilling following adding a joint of drill pipe, there usually is a period of a few minutes during which no flow is observed at the blow line, followed by a spray of "lathered" liquid. This evident slug lasts but a minute or two, and is usually followed by a varying two-phase flow shown in Figure 4. There is a steady stream of fast-moving air containing some mist and a large number of relatively large cuttings traveling at high velocity; and there is also discharged a slow-moving, tightly-foamed liquid that carries a few large cuttings and a large amount of fines. This may "head up" on occasion, but heading is less evident with the better agents; and too much heading results in rising compressor pressure and decreased drilling rate.

It seems likely that cuttings removal is not adequate until a continuous column of fast moving gas or mist exists from the bit to the surface and that within the hole there also is a rising annular ring of foamy liquid. After deflection at the wellhead, the liquid collects by gravity segregation in the lower part of the blow line and is, therefore, not seen as an annular ring on discharge.

The well conditions described are difficult to duplicate in the laboratory. In one study,[8] the well and drill string were modeled and measure-

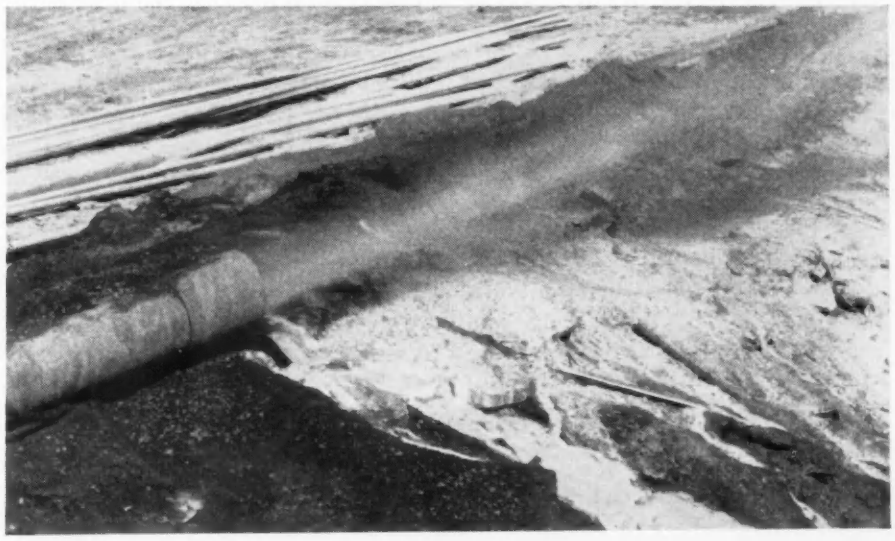


FIGURE 4—Normal flow line conditions while using a foaming agent in the air circulating system.

FIGURE 5—A typical layout of foam drilling equipment.

ments were made of foam production rate, foam stability, and water and cuttings carrying capacity at a specific flow rate. An interesting conclusion was reached that surface tension could be lowered by some agents to a value too low for effective water-carrying capacity.

While such tests are strongly indicative, it must be admitted that performance can only be judged under actual well use. Those agents which remove water and cuttings at low operating pressures, give little heading and are economical are those which see continued use. There is also some indication that the best agent for a particular application varies with field conditions.

Agents which perform best are nonionic foamers. These perform well in the presence of salty formation waters, and are not strongly adsorbed by cuttings. Anionics are not generally good foamers in the presence of salty formation waters, and cationic agents tend to be adsorbed and deactivated in the presence of fine solids. Thus, composition of formation water has considerable effect.

Foamers also are adversely affected by any crude oil entering the well bore although foam drilling has been done successfully with weak oil flows. There seems to be little difficulty in foaming with dry natural gas, but compressed exhaust gases severely inhibit foam.

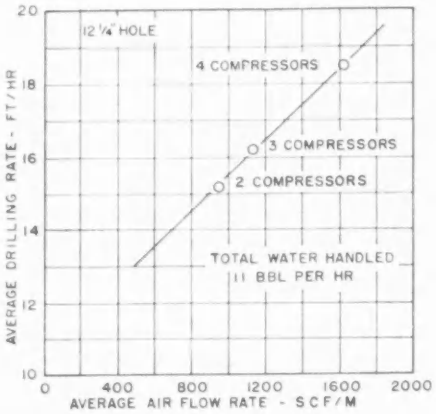


FIGURE 6—Effect of air circulation rate on foam drilling rate.

Another factor affecting foaming is the corrosion inhibiter. With fresh formation waters, corrosion is not a severe problem; but it can be severe when salt content of water is high. Red rust coloring sometimes shows at the flow line, and the pipe may part frequently. This is most often combatted by using one to three pounds of lime per barrel of injected water, and the lime injection rate is adjusted to keep the pH of the blow line discharge at 8.5 or above. Some use has also been made of proprietary inhibitors.

Other factors affecting performance are type of solids drilled, quantity of water handled, and circulating air temperature. Regardless of the many requirements, there are several commercially available foaming materials that have functioned very well.

Field use of the agents. The first indication of water in the hole is cessation of flow of blow line dust. It is necessary to begin injection of separation agents or water before further drilling.

Assuming that water injection is begun immediately, a mixture of foaming agent, water and anti-corrosion agent is prepared; or water with anti-corrosion agent is prepared and the foamer is handled separately by a small chemical injection pump. If the foamer is handled in a water mixture, a good beginning concentration is 0.25 percent or 1 gallon to 10 barrels. After "slugging" in a barrel or so of solution, the injection rate may be tried at about 10 barrels per hour. The flow should stabilize as previously described for the period following adding a joint of drill pipe.

Depending upon conditions, particularly the volume of water flowing into the well, the concentration of agent used may need to be changed. Concentrations of from 0.06 to 0.4 percent by weight of the total water foamed have been used. If insufficient agent is added, there will be considerable heading at the blow line. If too much agent is used, the well may head with slugs of greatly lathered foam and no liquid discharge. The lowest concentrations or rate of agent addition that gives relatively steady flow from the blow line is the amount desired.

At the higher water rates, there is a substantial accumulation of water in the hole following each connection of a new pipe joint. To clean the hole and resume steady flow, it may be necessary to pump in a barrel or so of solution or add a small amount of foamer quickly. This procedure has led to the term "slug" drilling.

The limiting rate of formation water influx handleable by foam techniques is not defined. Foam drilling has been used with flows in excess of 200 barrels per hour. Chemical treating and compressor requirements rise rapidly above 50-60 barrels per hour, and these result in costs that often make water shutoff or conversion to water drilling more economical.

With the higher flow rates, the annulus is loaded with water to the extent that high air pressures are

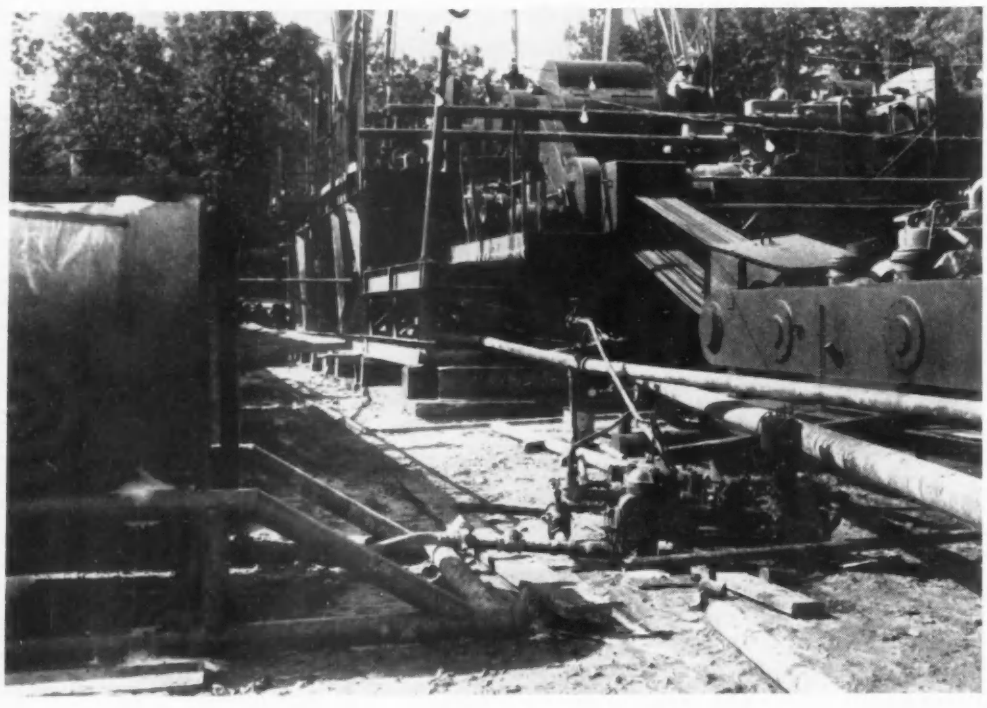


FIGURE 7—Mixing tank and injection pump used in mixing foaming agents.

necessary. Some advantage is gained by increasing the rate of water injection to reduce the difference in head in the drill string as compared to the annulus.

Equipment and air volume requirement. There are several items of equipment required for foam drilling in addition to usual rotary equipment, the foremost of which is air compressors.[9]

Oil well drilling has largely adopted the compressors used in construction and other industries. Probably the most extensively used units to date have been of the reciprocating type rated to 500 cfm at 100 psi with a maximum pressure of 350 psi. These have been skid-mounted with unitized driving engine or driven from the rig transmission compound. Figure 5 shows four such units, two driven by the rig motors and two with their own drive.

Other good units with higher volume and pressure ratings are available. Some are two-stage, some have blower-type superchargers, and there is a type with a mist extractor that removes automatically the condensed water.

When high pressures are required, booster compressors are used. One unit is capable of boosting 1000 cfm from 100 to 500 psi, and pressures as high as 1,500 psi can be produced by some equipment.

Air or gas volume requirements are basically those of air drilling, and the tables of Angel[10] intended to produce 3,000 feet per minute velocity of standard air are widely used for computing minimum requirements. Flow and pressure requirements increase with the amount of water handled, even though foaming agents are effective in keeping the requirements low compared to air blowing untreated water.

Table 1 shows an approximate range of air requirements in foam drilling. Whether the low values are usable depends upon the amount of water handled, and both the volume and pressures could be further reduced if all drilling were shallow as, for example, only to 1,000 feet.

TABLE 1—Range of Air Requiremnts for Foam Drilling
(Rated Compressor Capacity Basis)

Hole Size:	12¼ In.	7⅞ to 9 In.
	0 to 5000 ft.	5000 to 12,000 ft.
Air Volume, cfm: 1500—4000	2000—2500	2500—4000
Air Pressure, psi: 60—350	200— 350	300—1500

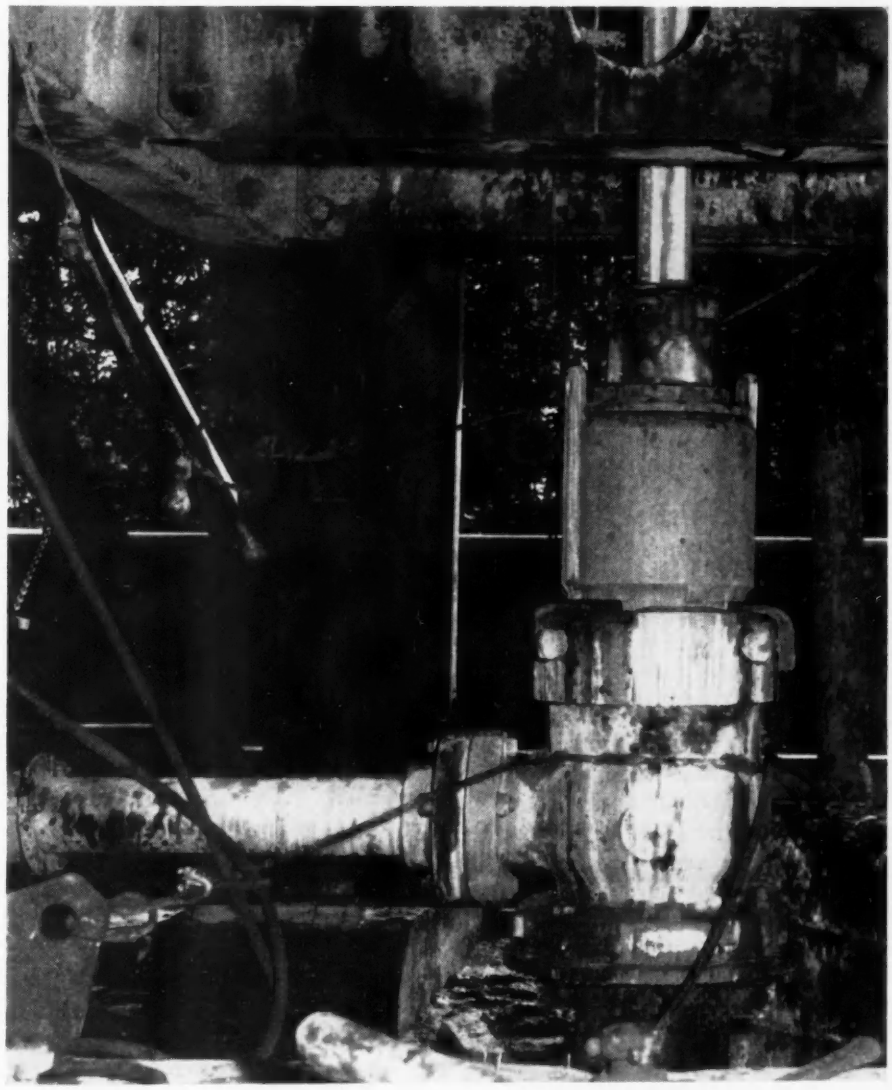


FIGURE 8—Wellhead assembly used for foam drilling in Pennsylvania.

There is no exact answer in any one well as to the air required as may be illustrated by Figure 6. In drilling several wells in one field, three 500 cfm air compressors had been used successfully to drill the 12¼-inch hole with foam. When tests were made using two, three, and four compressors, the data of the figure resulted, indicating that air volumes above those which appear to be adequate speed drilling rates. The data are also of interest because they indicate that measured air volumes may be different from rated compressor performance.

As might be expected from the preceding statement, air metering installations are not a necessity but do provide helpful information. Figure 7 shows an example of a meter run installed to measure injected air volume and pressure.

Mixing tanks for injected water may be of any convenient size. The one in Figure 7 has a 50-barrel capacity. Also shown is a 4-inch by 6-inch steam displacement pump operated on compressed air and used to handle the injected solution. Chemical-injection pumps to handle the foaming agent separately give better control of injection rates. These should have a capacity range of about 0 to 5 gallons per hour.

As in air drilling, the wellhead must be equipped with a rubber rotating head assembly to deflect fluids and cuttings into the blow line. A conventional unit is shown in Figure 8.

Field results. The most extensive comparison to date of air and foam drilling rates was presented by Jackson[11] who collected data on 226 wells,

all of which were started with air in the general Rocky Mountain region. Of these, 36.2 percent were completed with air alone, 15 percent were forced to convert to conventional muds, and 48.7 percent successfully overcame fluid invasion without conversion.

Of course, all these wells were started in locations where air drilling was thought possible and do not convey an idea of the generally prevailing proportion of air drilling compared to mud drilling. However, the data do indicate the expansion of air drilling brought about by the introduction of methods capable of handling water—principally foaming.

Calculations based on the data presented in the above reference show that the wet air jobs averaged 73 percent of the dry air drilling rate and 70 percent of the bit life.

In the Appalachian area foaming has been done principally in 12¼ inch surface hole drilling to about 1,200 feet, although some use has been in other size holes and at greater depths. It has nearly all been done in sandstone and hard shale formations. Figure 9 shows the improvements in 12¼ inch hole drilling rate as experienced by one contractor in this area since 1953.

Based on six wells drilled with mud in 1953 and 1954, the average rate of penetration was 6.5 feet per hour. From 1955 to 1957 inclusive, 32 wells averaged 7.85 feet per hour using principally combinations of air, injected water and booster compressors. During 1958 foaming was adopted, and 16 wells averaged 10.6 feet per hour. In the first eight months of 1959, 25 wells averaged 17.0 feet per hour.

A greater improvement has occurred since institution of foam practices than was shown by changing from drilling mud or air-water drilling. This has been due in large measure to continued improvement in foam practice such as use of more effective agents, greater air volumes, and experience of the rig crews. Other measures not directly associated with foaming such as increased bit weight have also contributed, but it would not have been possible to gain the improvement shown from these measures without the good hole cleaning provided by foaming. The significance of these statements may be further appreciated from the fact

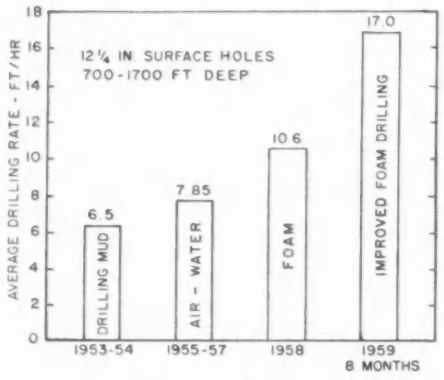


FIGURE 9—Comparison of mud, air-water and foam drilling rates in Pennsylvania.

that drilling costs in 1959 to date were 38 percent less than in 1958.

There also has been continued improvement in bit footage during the period covered, but the greatest improvement has occurred recently from the use of tungsten-carbide insert bits. Three wells drilled with these bits have averaged 1,640 feet per bit compared to an average 175 feet per bit for 13 wells in the early part of 1959. This indicates a possible wide use of this type of bit in the large hole foam drilling.

The deeper 8¾ inch holes in this area have been drilled principally with air, but in some instances it has been necessary to foam this interval to about 7,000 feet. From limited data it appears that the penetration rate with foam has been about 80 percent of that with air and in the range of 22-28 feet per hour. As the air drilling rate has been about four times the drilling mud rate, the comparison with mud is outstanding. Similarly, the bit footage with foam has been about half that of air drilling, but still double bit footage with mud.

Most of the holes have shown almost no tendency to slough while foaming, although some difficulties have occurred when softer shales were exposed and on occasion it has been necessary to convert to liquid.

Problems and future potentials. Greatest deterrents to wider use of foam drilling are sloughing shale and water disposal.

Some shale formations withstand the stresses of a low pressure hole and the wetting effects of the foam fluids very well; but in some instances, the formation materials slough severely, sticking pipe or at least forcing mudding up of the hole. One suggested solution is to inject a chemical that will coat the formation, protecting against wetting; but to date no effective method has been developed.

Disposal of water is not too difficult at low water flow rates as it may be caught in open pits and allowed to soak into the ground and/or evaporate. At high water rates, very large pits must be provided or the materials drained into isolated barren areas where no damage can result. Fortunately, the chemicals used can be regarded as not being more toxic than soap solutions and really serious complications are unlikely.

Another possibility for future improvement is the injection of extreme pressure lubricants into the fluid stream to extend bit bearing life. Foamers that are unaffected by crude oils are a real need. The oil resistant feature would not only help in present drilling but would extend the technique to include low pressure completion of oil wells.

ACKNOWLEDGMENT

The authors wish to express their appreciation to the management of Gulf Research & Development Company and to Delta Drilling Company for permission to publish this article. Also, appreciation is expressed to P. W. Schaub and George Bonner of the companies listed, respectively, for their assistance in field work and preparation of the paper.

LITERATURE CITED

[1] Hower, F., C. McLaughlin and J. Ramos, "Water Can Be Controlled in Air and Gas Drilling," *T.P. 1099-G*, Fall Meeting, AIME, Houston, Texas, 1958.

[2] Goodwin, R. J., and A. J. Teplitz, "A Water Shutoff Method for Sand Type Porosity in Air Drilling," *Journal of Pet. Tech.*, 11(7), p. 163.

[3] Cunningham, R. A., and J. G. Eenink, "Laboratory Study of Effect of Overburden, Formation and Mud Column Pressures on Drilling Rate," *Paper 1094-G*, Fall Meeting, AIME, Houston, Texas, 1958.

[4] Murray, A. S., and R. A. Cunningham, "Effect of Mud Column Pressure on Drilling Rate," *Trans. AIME* (1955), 204, p. 196.

[5] Eckel, John R., "Effect of Pressure on Rock Drillability," *Trans. AIME* (1958), 213, p. 1.

[6] Garnier, A. J., and N. H. Van Lingren, "Phenomena Affecting Drilling Rates at Depth." *Paper 1097-G*, Fall Meeting, AIME, Houston, Texas, 1958.

[7] Bobo, R. A., G. S. Ormsby, and R. S. Hock, "Phillips Tests Air-Mud Drilling," *The Oil and Gas Journal*, January 24, 1955, pp. 82-87, and February 7, 1955, pp. 104-108.

[8] Randall, B. V., J. L. Lummus, and R. P. Vincent, "Combatting Wet Formations While Drilling with Air or Gas," *The Drilling Contractor*, October 1958.

[9] Warrington, F. D., and W. A. Triest, "Evaluation of Air Compressors for Drilling Service," *Petroleum Equipment*, July-August 1959, pp. 39-40.

[10] Angel, P. R., "Volume Requirements for Air or Gas Drilling," *Trans. AIME* (1957), 210, pp. 325-330.

[11] Jackson, Gordon, "Air Drilling," *Drilling* 7, July 20, 1959, pp. 99-100. Also, "An Analysis of Air Drilling," Spring Meeting, API Div. of Prod., Los Angeles, California, 1959.

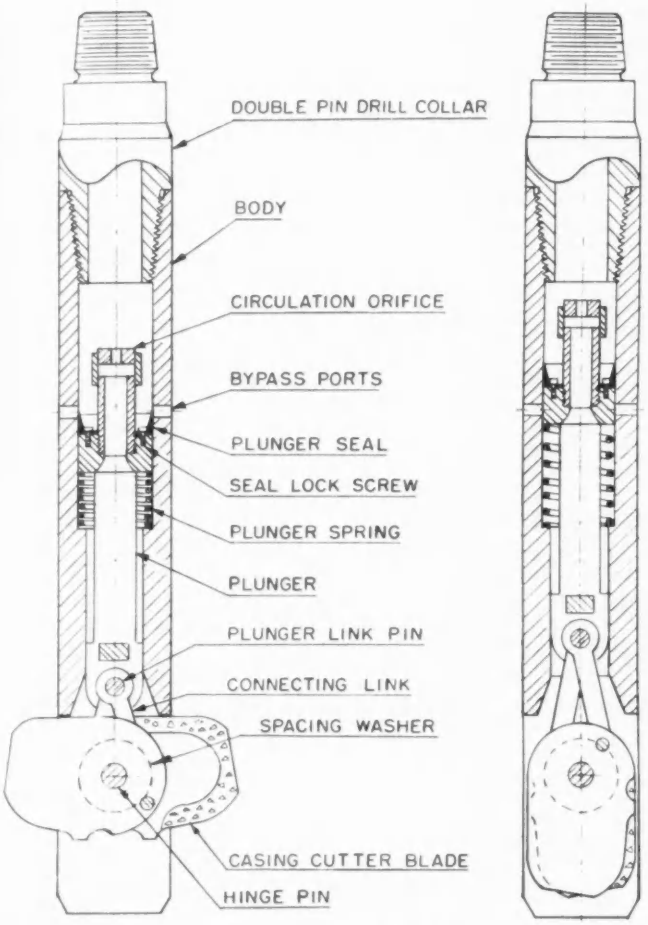


FIGURE 1—This cutting tool is used both to remove a ring section from the casing and to notch the formation with a V-shaped circumferential notch. The tool is shown equipped with casing cutting blades. The pointed blade shown in Figure 2 is substituted when the formation is notched.

FIGURE 2—Two types of blades used with the mechanical cutting tool: the formation notching blade (top) and the casing cutting blade (below).

New notching tool improves fracturing

Technique provides an entry point of known configuration in the formation, improves control of the plane of initiation of a subsequent hydraulic fracture

By J. L. Pekarek and J. L. Huitt,
Gulf Research and Development Co.
and V. N. Swift and H. L. Strider,
Gulf Oil Corporation

A MECHANICAL TOOL, special notching blades and an operational procedure have been developed for use in the preparation of a wellbore for hydraulic fracturing. A circumferential V-shaped notch cut with the mechanical tool provides an entry point in the formation of known configuration that enhances control of the point and plane of initiation of a subsequent hydraulic fracture. From field results obtained in some 40 cases at depths to 8,822 feet, it is apparent that the mechanical tool provides an excellent method of preparing a wellbore for hydraulic fracturing.

Wellbore preparation for hydraulic fracturing has become an integral part of the planning of well stimulation treatments. Originally, the point of fracture initiation in a given interval of a formation was more or less left to chance. However, considerable effort now is expended to control the point and/or plane of fracture initiation.

One of the earliest efforts to limit the point of fracturing and/or to control the fracture initiation plane was the completion of a well with a limited open-hole section below the casing. While this method has been satisfactory in some cases, open-hole completions are not always desirable.

With casing set through the productive formation, attempts to control the fracture initiation have been primarily by use of multiple explosive charges either placed in a single plane[1,2,3] or arranged to result in a convergence of forces on a plane formed by other explosive charges.[4] While each of these methods has been successful, a recent method of wellbore preparation provides a penetration pattern that is continuous around the periphery of the borehole and is not dependent on the characteristics of the formation rock.

In the new method, a circumferential V-shaped notch is cut mechanically. (The circumferential notch can also be cut by hydraulic jetting[5]; however, sufficient data on the results of field operations with the hydraulic jet method of notch-cutting are not available at the writing of this article.) In cutting a notch mechanically, notch shape depends upon control of the cutting tool and cutting blade design.

This article discusses a mechanical tool with which the cutting action can be controlled. Also discussed are the operational procedure for wellbore preparation and the blades that were designed to obtain the desired shape circumferential notch.

NOTCHING TOOL

The tool shown in Figure 1 was used to perform the jobs discussed in this article. In this particular tool, the cutting blades (Figure 2) pivot about a fixed pin in the tool body.

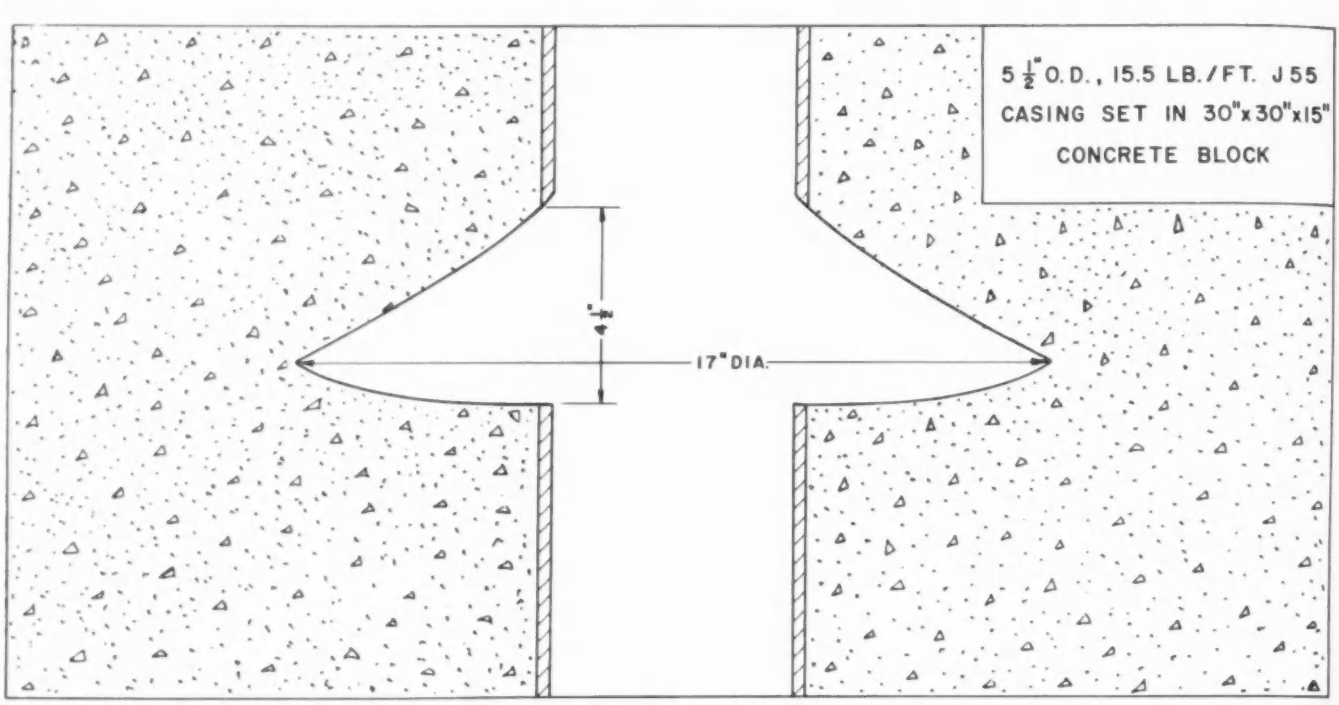


FIGURE 3—This schematic drawing shows the size ring section removed from the casing and the resulting notch.

Once blades are extended, in routine operations, an underreaming tool is usually operated until the wellbore is reamed for the necessary footage. However, for cutting a notch a few inches in width at the wellbore it becomes necessary to know precisely when the blades are extended to a predetermined position. To accomplish this, bypass ports are placed in the tool body so that when the plunger assembly (Figure 1) is in the proper position for the blades to be extended correctly, fluid circulates through the ports. This fluid circulation through the ports would be noted on the surface as a reduction in the fluid pressure.

In addition to the bypass ports, the tool body is open beneath the blades. This permits the use of special blades for notching the formation and in the event of blade breakage, it prevents the wedging of the blade between the tool body and casing.

Also, a circulation head for the plunger assembly was designed to permit easy replacement of the circulation orifice in the event of wear. The head also permits some build-up of solids on the plunger assembly without the circulation orifice becoming plugged.

Blades. Early test results with commonly used underreaming blades showed that special blades would be necessary to obtain a V-shaped notch in the wellbore. In designing the blades there were three principal considerations:

- For cased holes, blades with which a V-shaped notch could be obtained were impracticable for cutting a ring section from casing commonly used in well completions. Thus, it was necessary to have one set of blades for removing a ring section from the casing and a second set to cut a V-notch in the formation.
- A narrow ring section should be removed from the casing, but it should be of sufficient width for the formation-notching blades to enter.
- Formation-notching blades should penetrate the formation adequately, yet blade length should be such that the dynamic load developed during cutting would not exceed the yield and/or impact strengths of the blade material. Also, each set of blades should retract into the tool body.

Figure 2 shows a casing-cutting blade and a formation-notching blade used primarily in 5½-inch casing. Both blades are made of SAE 4140 (or 4137) steel and the cutting edges are hard-faced. The edge of the casing-cutting blade contains tungsten-carbide chips of —¼ + 3/16 inch size, while the cutting edge of the formation-notching blade contains tungsten-carbide chips of 40-60 mesh size.

With the casing-cutting blade shown in Figure 2, a ring section of 4½-inch is cut in 5½-inch casing and 3½-inch in 7-inch casing. With the particular formation-notching blade shown in Figure 2, a notch of 17 inches in diameter is cut. Similar blades also were developed for operation in other sizes of casing.

Experimental Operations

To evaluate the use of the tool and blades for notching a wellbore, a number of tests were made in which the results at various stages of the operation could be determined. Initial surface tests were made in short sections of 5½-inch casing set in 30-inch x 30-inch x 15-inch cement blocks. A 1,500-foot capacity drilling rig was used to operate the tool and water was used as the circulating fluid. Results indicated that tool and blades functioned satisfactorily.

The size ring section cut from the

casing and the resulting formation notch are illustrated in Figure 3. As the blades reached the proper extension, the rupture of the plunger seal permitted the circulation of fluid through the bypass ports. This occurred as the blades were tilted slightly downward as evidenced by the notch illustrated in Figure 3.

In addition, a shallow-hole test at a depth of 71 feet in 5½-inch casing was made as the first down-hole evaluation and results were satisfactory. A fracture was initiated at a pressure considerably lower than that required in an earlier fracturing test in the same sand.

The fracture initiated at the mechanically cut notch was extended to intersect four surrounding observation wells; it was found to diverge two feet from a horizontal plane at a distance of 50 feet from the well that had been fractured.

Results of this test indicated that operation of the tool down-hole could be controlled sufficiently to work in an interval of a few inches and that the wellbore preparation was satisfactory for a fracturing operation.

Field Applications

The mechanical tool has been used in 40 wellbore-notching operations in casings of 4½-inch to 7⅝-inch diameter. This has necessitated use of three different tool sizes. The first use of the tool for a notching operation was at a depth of 2,960 feet. Since then, wellbore notches have been cut at depths of 1,761 to 8,822 feet.

Wellbore preparation. At the beginning of each operation, the tool is lowered into the well on the drill string to a depth of about 30 feet. The drill string then is connected to permit fluid circulation and the flow rate required to develop 600 psi pump pressure is measured. (This flow rate is used later to insure that the tool is operated with approximately 600 psi pressure differential through the circulation head.)

The drill string then is disconnected from the circulation system and the tool is lowered to the desired depth. (The kelly joint is marked with chalk for future reference.) The drill string is connected for circulation and the flow rate previously selected is established. Pressure required for this flow rate is then maintained during the remainder of the cutting.

Rotation of the tool is begun at approximately 70 rpm. The same rotational speed and pump pressure are maintained for about one hour. This is usually sufficient time for a groove to be cut in the casing. The drill string is lowered slightly to place about 2,500 pounds weight on the cutting blades while the rotational speed and pump pressure cited above are maintained. This weight is maintained while the casing is cut.

As the blades expand in the casing cut, an instantaneous drop in the fluid circulation pressure of 300 to 400 psi is noted after which the tool is rotated for an additional 15 minutes to insure that the cut is smooth and sufficiently open to enable the formation-notching blades to slip easily into it.

The drill string rotation and fluid circulation are stopped and the drill string is lifted about 1 foot. Fluid circulation is begun and the circula-

TABLE 1—Summary of Wellbore Notching Operations

Case No.	LOCATION		CASING			Depth of Tool Operation (Ft.)	Formation	TOOL OPERATION (Hr.)	
	County	State	Type	Size (In.)	Weight (Lb./Ft.)			Casing	Formation
1	Wayne	Illinois	J-55	5½	15.5	2,960	Aux Vases Sand	6	2
2	Sublette	Wyoming	J-55	5½	14.0	3,353	Mesaverde Sand	13¼	6½‡
3	Sublette	Wyoming	J-55	5½	14.0	3,275	Mesaverde Sand	11¼	2½
4	Morgan	Colorado	J-55	5½	14.0	6,159	Dakota "D" Sand	9¼	11¼‡
5	Sublette	Wyoming	J-55	5½	14.0	3,190	Mesaverde Sand	9½	3¼
6	Sublette	Wyoming	J-55	5½	14.0	1,761	Tresner Sand	4¾	3½
7	Sweetwater	Wyoming	J-55	5½	14.0	3,828	Ft. Union Sand	7	½
8	Morgan	Colorado	J-55	5½	14.0	6,129	Dakota "D" Sand	2	2½
9	Guadalupe	Texas	J-55	5½	15.5	2,378	Eagleford Shale	3	½
10	Guadalupe	Texas	J-55	5½	15.5	2,398	Austin Chalk	2¾	½
11	Guadalupe	Texas	J-55	5½	15.5	2,420	Buda Lime	3½	1
12	Guadalupe	Texas	J-55	7	23.0	2,416	Eagleford Shale	2	1
13	Morgan	Colorado	J-55	5½	14.0	6,127	Dakota "D" Sand	5¾	5¼‡
14	Morgan	Colorado	J-55	5½	14.0	5,847	Dakota "D" Sand	7¼	3½
15	Morgan	Colorado	J-55	5½	14.0	6,187	Dakota "D" Sand	4¼	4½
16	Dimmit	Texas	J-55	7⅝	26.4	3,846	San Miguel Sand	2¼	1
17	Morgan	Colorado	J-55	5½	14.0	6,217	Dakota "D" Sand	4	4½
18	Garfield	Colorado	J-55	5½	14.0	4,223	Buckhorn Sand	4	1
19	Crane	Texas	J-55	5½	15.5	5,980	Connell Sand	3	6
20	Guadalupe	Texas	J-55	4½	11.6	2,366	Buda Lime	3	2
21	Sublette	Wyoming	J-55	5½	14.0	3,296	Mesaverde Sand	4½	2½
22	Guadalupe	Texas	J-55	4½	11.6	2,354	Buda Lime	2¾	3
23	Polk	Texas	N-80	5½	17.0	8,294	Wilcox "A" Sand	4	1½
24	Morgan	Colorado	J-55	5½	14.0	6,158	Dakota "D" Sand	4¾	7¼
25	Guadalupe	Texas	J-55	4½	11.6	2,400	Buda Lime	3	2
26	Morgan	Colorado	J-55	5½	14.0	5,835	Dakota "D" Sand	6	4
27	Crane	Texas	J-55	5½	15.5	3,485	San Andres Dolomite	4	2
28	Morgan	Colorado	J-55	5½	14.0	6,136	Dakota "D" Sand	4¾	4
29	Lamar	Mississippi	N-80	5½	17.0	8,822	Stringer Sand	1¼	¾
30	.....	Canada	J-55	4½	11.6	4,458	Mississippian Limestone	2½	1½
31	San Juan	New Mexico	J-55	5½	15.5	6,320	Grenaros Sand	27*	11*
32	Morgan	Colorado	J-55	5½	14.0	6,127	Dakota "D" Sand	4½	9½‡
33	Lamar	Mississippi	N-80	7	29.0	8,815	Stringer Sand	3	3½
34	Morgan	Colorado	J-55	5½	14.0	6,113	Dakota "D" Sand	5	7‡
35	Sweetwater	Wyoming	J-55	5½	14.0	3,837	Almond Sand	3½	7
36	.....	Canada	J-55	4½	11.6	4,442	Mississippian Limestone	4	1½
37	Morgan	Colorado	J-55	5½	14.0	6,122	Dakota "D" Sand	6¼	8¾
38	Sweetwater	Wyoming	J-55	5½	14.0	5,178	Almond Sand	24†	1

* Tool run on 2⅞ inch tubing and rotated with power tubing tongs.
† Cutting blades of somewhat different design than used previously.
‡ A broken blade necessitated the tool being run in the hole with formation-notching blades a second time to complete the formation notching.

tion pressure previously noted is obtained. The tool is lowered slowly to recheck for the pressure drop as the casing-cutting blades slip into the casing cut.

In the second phase of the operation, the tool (with formation-notching blades) is lowered in the hole to a point approximately 1 foot above where the tool was positioned for the beginning of the cutting of the casing (determined by chalk mark on kelly joint). The drill string is connected for circulation and the pump pressure previously maintained during the casing cutting is obtained.

Rotation of the tool is begun at about 40 rpm. The tool is lowered very slowly without placing weight on the blades until a drop of 300 to 400 psi is noted in the fluid circulation pressure. (Should the blades catch in the casing cut, the cutting becomes rough and excessive torque is exerted on the drill string.)

When the drop in pressure occurs, drill string rotation and fluid circulation are stopped. The drill string is lifted about two feet and fluid circulation is begun again. The tool is lowered slowly to insure that the formation-notching blades slip into the notch. This check on the pressure-drop signal assures that the notching operation is completed.

Results. For the 38 wellbore-notching operations summarized in Table 1, three tool sizes were used for operation in 4½ to 7⅝-inch casing. After the first few tests the same operational procedure was used at each of the various depths at which a notch was cut, and no difficulty was encountered in operations at the greater depths.

In all wells but one, the tool was operated on drill pipe (or drill tubing). In the one exception, a string of 2⅞-inch tubing was rotated with power tubing tongs. This resulted in a time of 27 hours for cutting the casing and 11 hours for notching the formation. In another test with a somewhat different design of casing-cutting blade, 24 hours were required for cutting the casing.

These operational times were considered excessive even though they were of an experimental nature. If these are excluded, the average time for the operations summarized in Table 1 were 4¾ hours for cutting the casing and 3½ hours for notching the formation. In five cases, the formation-notching blades were broken. Even though this necessitated a round trip to replace the blades, results were considered excellent since only one of the six individuals who operated the tools had prior experience with such equipment.

The effect of a wellbore notch on the subsequent fracturing treatment was discussed in a recent article.[5] Only in one well was the fracturing operation hampered; and in this well, a casing failure resulted before the fracture could be initiated. In all other cases results indicate that the fracturing treatment was facilitated by the use of the notch in preparing the wellbore for fracturing, especially when a large-size propping agent was used.

The results following the fracturing operations are naturally dependent upon the fracturing treatments as well as the method of wellbore preparation. Inasmuch as the wellbore preparation was an integral part of the designed treatment, it is difficult to evaluate the wellbore preparation separately. Still, over-all results as indicated by the early production histories have been excellent.[5]

At this time the trend in hydraulic fracturing is toward the use of a single entry point (plane) in the wellbore and employment of propping agents of large size. By use of the mechanical tool, a single-point entry is obtained that facilitates the use of large-size propping agents.

ACKNOWLEDGMENT

This article is taken from a paper entitled "Mechanical Tool for Preparing a Wellbore for Hydraulic Fracturing" which was presented to the Rocky Mountain District Spring Meeting of API, Division of Production, Casper, Wyo., 1960. The authors wish to express their appreciation to the Management of Gulf Oil Corporation and Gulf Research & Development Company for permission to publish this paper and to the Baash-Ross Division of Joy Manufacturing Company, Houston, for their cooperation in the evaluation of the mechanical tool.

LITERATURE CITED

[1] Griffin, W. H., "The Welex Four-Way Jet Gun." Technical Brochure of Welex Jet Services, Inc., Fort Worth, Texas, May 20, 1952.

[2] Gilbert, Bruce, G. Neill, and R. Clark, "How Fracture Initiation Can Be Controlled," *Oil and Gas Journal*, pp. 64-67, August 5, 1957.

[3] "8-Way Barrier Jet Cracks Deep Horizontal Fractures," an advertisement of Jet Research Center, Inc., of Arlington, Texas, *Oil and Gas Journal*, pp. 174-175, October 21, 1957.

[4] "Tool Perforates, Fracs at Same Time," *Petroleum Week*, p. 21, November 27, 1959.

[5] Huitt, J. L., "Hydraulic Fracturing with the Single-Point Entry Technique," *Journal of Petroleum Technology*, pp. 11-13, March 1960.

About the Authors

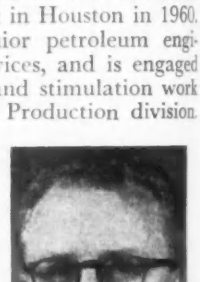
J. L. Pekarek

V. N. Swift

J. L. Pekarek, a research engineer for Gulf Research & Development Company, has worked in the Well Stimulation Section of the Production Engineering Division for the past three years. He received his B.S. degree in mechanical engineering in 1957 from Pennsylvania State University. He received his M.S. degree in mechanical engineering from Carnegie Institute of Technology in June.

Virgil N. Swift received a B.S. degree in petroleum engineering from the University of Tulsa in 1952 and joined Gulf Oil Corporation upon graduation. He served as production foreman and senior petroleum engineer in Gulf's Denver district until transferred to the Technical Services Department in Houston in 1960. He is presently senior petroleum engineer, Technical Services, and is engaged in well completion and stimulation work for Gulf's Domestic Production division.

H. L. Strider



J. L. Huitt

H. L. Strider received a B.S. degree in chemical engineering from the University of Missouri in 1949. He joined Gulf Oil Corporation following graduation and has held the positions of drilling engineer, zone production and mechanical engineer, area production foreman and area engineer. He is presently area engineer in the Casper, Wyo., area.

J. L. Huitt is a section head in the Production Engineering Division of Gulf Research & Development Company. He holds a B.S. degree in chemical engineering from Louisiana Polytechnic Institute, and the M.S. and Ph.D. degrees from the University of Oklahoma. He was formerly a member of the chemical engineering staff at the University of Oklahoma and came to Gulf Research & Development Company from the Magnolia Petroleum Company Field Research Laboratory in 1956.

Index maps aid air/gas drilling operations

Operators are able to reduce well cost by selecting areas most adaptable for air/gas drilling

By Anthony Gibbon
Mid-Continent District Editor
WORLD OIL

IMPROVEMENTS IN AIR/GAS drilling technology during the past several years have resulted in a steadily increasing number of applications in oil-well drilling in many sedimentary basins throughout the United States. This has been a timely contribution to the search of oil operators and drilling contractors for ways to reduce well drilling costs.

It is generally recognized that the key to well cost reductions is good programing. Since methods and techniques are among the most important elements in programing, oil operators and drilling contractors are constantly vigilant for new approaches which may offer possibilities of cost reductions. The Rocky Mountain area has responded to the general upward trend in the application of air/gas drilling, but there has been no medium through which this over-all progress could be observed and analyzed as to areas and formations adaptable to this method, unless undertaken on an individual company basis.

The growing importance of air/gas drilling prompted a Denver firm to conduct an extensive survey to determine the extent and details of this application in the Rocky Mountain area. Results of this study have been published in map form providing a new approach (Figure 1), which offers a convenient, comprehensive guide pointing out where well cost reductions may be possible through the use of air/gas drilling techniques.

The new index map of air/gas drilling operations is presented on a scale of 1 inch to 24 miles, and outlines the principal sedimentary basins in a 10-state area of the Rocky Mountain region, extending from the Canadian border into northern New Mexico and Arizona. The map is designed to answer the three most important questions by which to judge the applicability of air/gas drilling in programing both exploratory and development wells: where, why and in what formations this technique was applied successfully. The survey covered the majority of exploratory wells and typical field development wells in which air or gas was used as a circulating medium.

The locations of more than 250 wells in which air/gas was successfully applied are represented by symbols which also explain the reason for its application, such as lost circulation, penetration improvement, formation evaluation, completion technique, or often a combination of these objectives.

The classification of an air/gas drilling operation as "successful" did not take into consideration the over-all economics of that application. Rather, it denotes that the purpose of the air/gas application as originally planned by the operator was achieved. Conversely, where the use of air/gas failed to gain the original objective, it was classified as "unsuccessful."

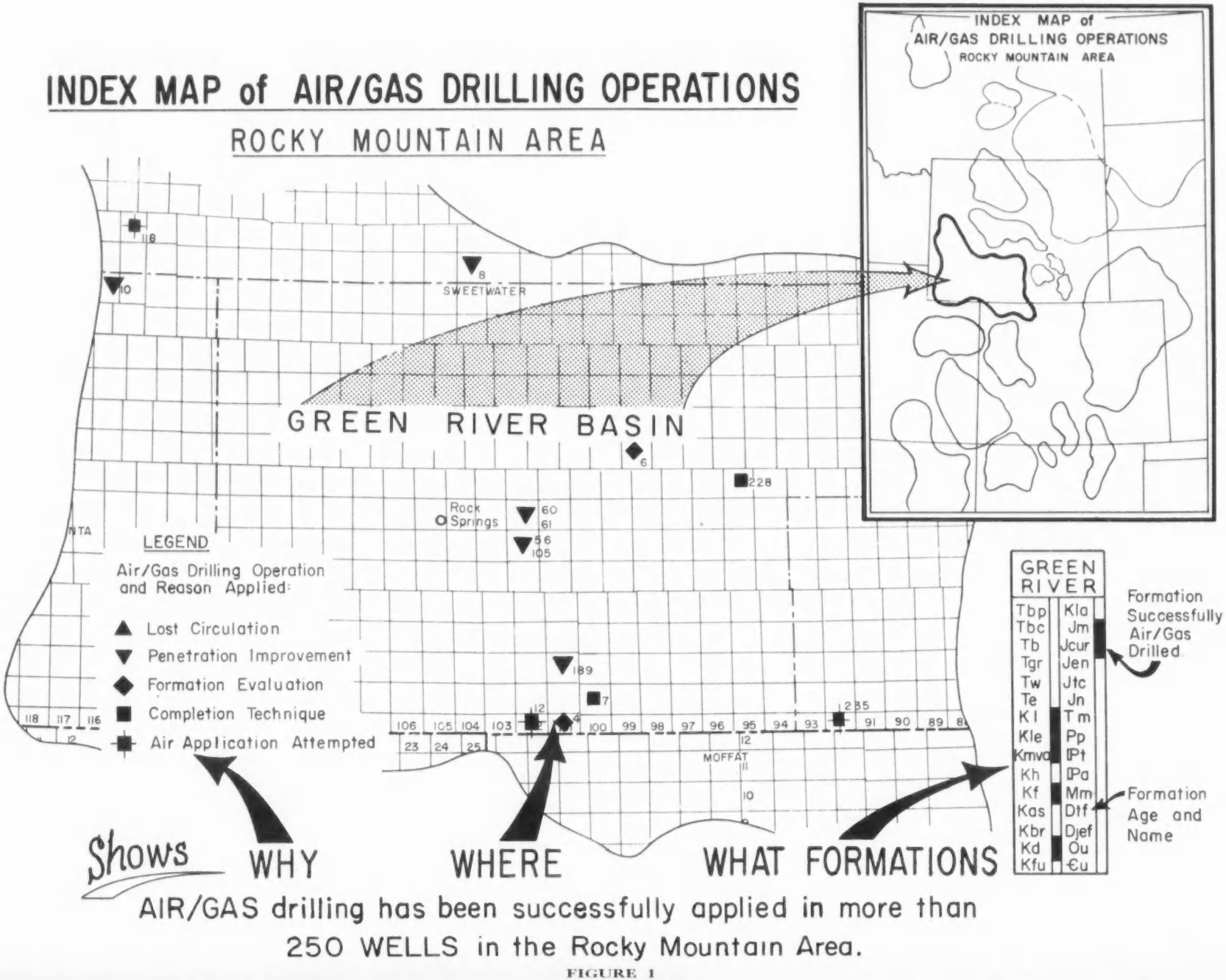
In view of the advances in air/gas drilling technology over the past five years, "unsuccessful" applications prior to Jan. 1, 1959, were not included on the map, as it is highly probable that the majority of unsuccessful air/gas drilling attempts in the past could be mastered with today's techniques.

Each major geologic subdivision or basin outlined on the map has one or more formation columns showing, by geologic symbols, formations present from the youngest to basement rock. Each formation within the basin which has been successfully air drilled is blocked in on the formation column. This provides a composite picture for the basin. Identification of formations successfully air/gas drilled in the individual wells can be found

See map on next page
Text continued on Page 79

TABLE 1—Relative Number of Different Air/Gas Applications Shown as Percentages of Total Successful Air/Gas Drilling Operations in Rocky Mountain Sedimentary Basins

	SUCCESSFUL APPLICATIONS AND REASONS APPLIED					
	Lost Circulation Problems	Improve Penetration Rate	Formation Evaluation	Completion Technique	Unsuccessful Air/Gas Drilling Attempts After 1-1-59	Number of Geologic Formations Successfully Air/Gas Drilled
Powder River	69.2%	23.0%	7.8%	.....	.....	11
Big Horn	18.8%	25.0%	.....	56.2%	.....	10
Teton	66.6%	33.4%	.....	.....	.....	1
Wind River	.....	100.0%	.....	.....	.....	6
Green River	.....	41.7%	16.7%	16.6%	25.0%	7
Uinta	22.2%	50.0%	5.6%	22.2%	.....	6
Piceance	33.3%	51.9%	11.1%	.....	3.7%	11
Uncompahgre Arch (Uinta-Piceance)	16.0%	44.0%	20.0%	20.0%	.....	9
Paradox	39.3%	60.7%	.....	.....	.....	18
Raton	100.0%	.....	.....	.....	.....	6
San Juan	8.3%	25.0%	.....	66.7%	.....	5



AIR/GAS drilling has been successfully applied in more than 250 WELLS in the Rocky Mountain Area.

FIGURE 1

Automatic gas well dewatering system cuts costs

New Pan American Petroleum installation uses water sensing device to regulate blowing frequency, reduces vented gas to a minimum

By M. C. Gillis, Area Engineer
Pan American Petroleum Corporation
Ulysses, Kansas

PAN AMERICAN PETROLEUM CORPORATION engineers have developed an automatic system for removing water from low pressure gas wells in the Hugoton area of Oklahoma and Kansas. Three such systems have been installed and all are working economically and efficiently. Although no tests have been conducted on wells outside of the Hugoton area, the system appears adaptable to producing water or condensate from higher pressure, deeper gas wells, where normal flow rates are too low to produce liquids by conventional flow through tubing.

Features of the system include:

- Water sensing device to regulate blowing frequency. Trial and error method is eliminated and vented gas is reduced to a minimum.
- Water level in the casing-tubing annulus is maintained at the bottom of the tubing string, thus providing no restriction to gas flow.
- Regular personnel attention for winding clocks. regulating blowing frequency etc. is not required.
- Is self-compensating for changes in line pressures and resultant changes in water production.
- Does not have to be shut-in when the well is closed. System operates only when water is being produced. This is a definite advantage in wet weather since lease roads are not maintained in Hugoton field.
- Is self-compensating for normal decline in wellhead pressure, except for minor adjustments, over an extended period of time.
- Provides a basis for additional well automation.

In most gas wells, water and other liquids are removed simply by producing them through tubing. Usually, gas velocity is sufficient to suspend and lift the liquids to the surface where they are extracted in a separator or scrubber.

Where producing pressures are low, many wells are produced through casing or through the tubing-casing annulus. This practice reduces flowing friction in the well bore, keeping surface flowing pressures as high as possible and reducing the energy required for compression to transmission line pressures. However, unless flow rates are unusually high, velocities in the well bore are not sufficient to carry liquids to the surface.

In many wells produced in this manner, water normally is removed by periodically blowing the casing or, where tubing is installed, by blowing the tubing. The tubing strings, which have been termed syphon strings, often are equipped with one or more small holes to aid in lifting the water. On wells which require frequent dewatering, many operators have installed clock controlled intermitters on the tubing. Intermitters are set to blow the tubing as often as necessary to keep the well essentially free of water. Addition of the time control, as compared to manual blowing, results in more efficient operation and maintains a higher average producing rate on the well.

The time controlled intermitter valve and syphon string is a simple, inexpensive method for removing the water, but in most cases it uses more gas than is considered necessary by normal gas lift practices. Furthermore, since this type system is dependent on human interpretation and regulation, it has numerous disadvantages.

Automatic dewatering system. To eliminate some of of these disadvantages, a water lift system has been devised which automatically removes water or other liquids from low pressure gas wells. This system adjusts automatically to variations in gas producing rates, line pressure or water influx rates. It employs the

FIGURE 1

250 WELLS in the Rocky Mountain Area.

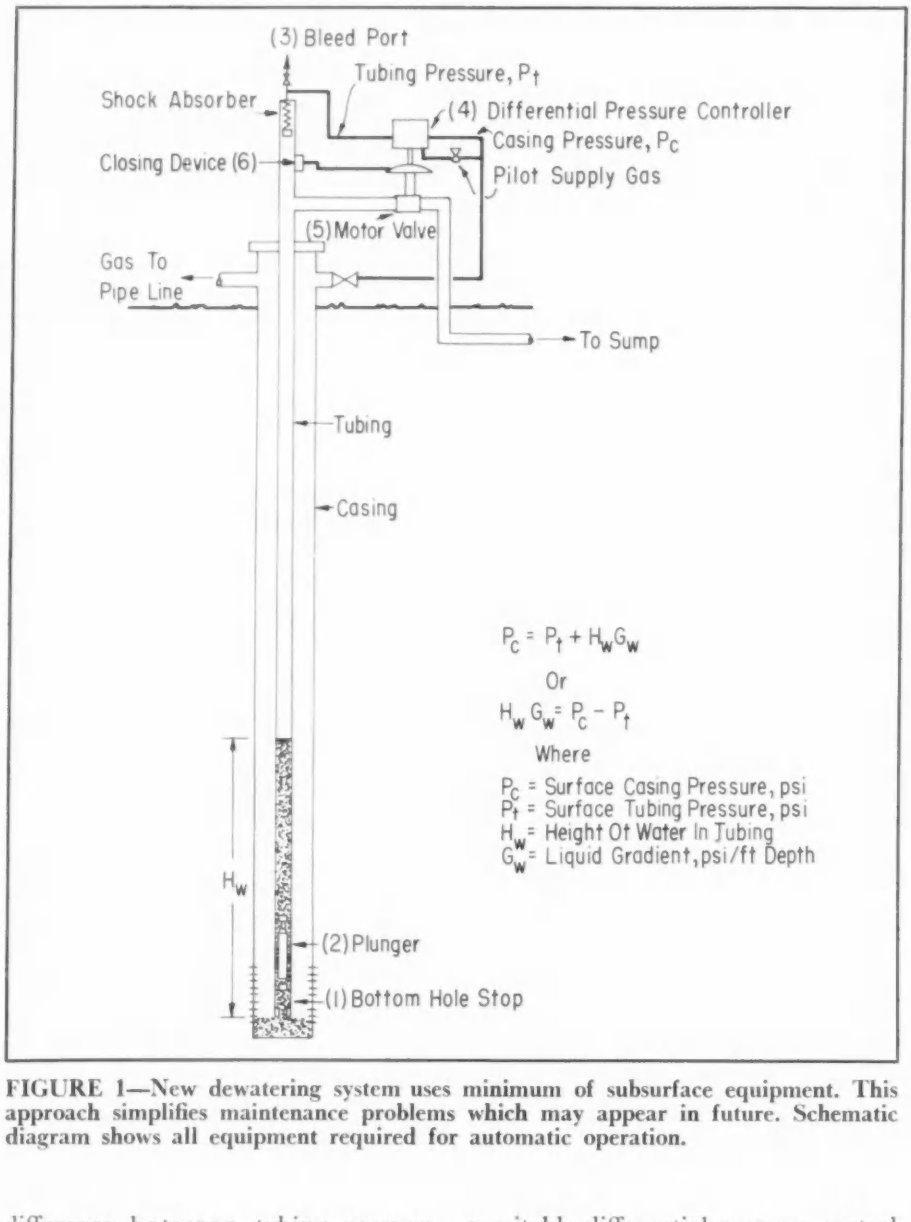


FIGURE 1—New dewatering system uses minimum of subsurface equipment. This approach simplifies maintenance problems which may appear in future. Schematic diagram shows all equipment required for automatic operation.

difference between tubing pressure and flowing casing pressure to sense the amount of water entering the well and to remove this water when a predetermined amount has accumulated in the tubing.

The system was designed with the following requirements in mind:

- To provide a simple, maintenance free, completely automatic field installation.
- To provide reasonable payout of necessary equipment through more efficient operation and savings in vented gas.
- To utilize a minimum of subsurface equipment which simplifies any possible future maintenance on the system.

Development of a system to meet these requirements was possible after a suitable differential pressure control and an adjustable bleed had been developed (Figure 2).

EQUIPMENT AND OPERATIONS

Equipment arrangement is shown schematically in Figure 1. It consists of the following: A tubing string set near or through the producing zone with a tubing stop (1) near the bottom; a plunger, (2) slightly smaller in diameter than the ID of the tubing which is free to move up and down the tubing; a controlled bleed port (3) which allows a small quantity of gas to vent from the tubing at all times; a differential pressure tripping mechanism (4) which operates the motor valve (5) whenever the difference between tubing and casing pressure reaches a maximum set value; and a closing mechanism (6) which shuts the motor valve (5) when plunger (2) arrives at surface.

The system operates as follows:

1. Beginning with the system clear of liquids in the tubing and well bore, the bleed port (3) in Figure 1 is set to vent gas at a rate slightly greater than expected water influx volume.

2. As gas is produced from the well through the casing annulus, water enters the well bore and is continually forced into the tubing by the reduction of tubing pressure caused by bleeding. Since movement of the water is slow, the water will by-pass the loose fitting plunger and water level in the annulus will be maintained at bottom of the tubing. At any time during the accumulation of water in the tubing, an approximate pressure balance is maintained as follows, neglecting friction drop in the annulus and weight of the gas column in tubing and annulus:

$$P_c = P_t + H_w G_w$$

or

$$H_w G_w = P_c - P_t$$

where

P_c = Surface casing pressure, psi
P_t = Surface tubing pressure, psi
H_w = Height of water or liquid in Tubing, feet
G_w = Liquid gradient, psi per foot of depth

3. As water rises in the tubing it causes a decrease in surface tubing pressure (P_t), thus causing the difference between casing and tubing pressure to increase. When this pressure difference reaches the value for which the differential pressure tripping mechanism (4) is set, the differential mechanism opens motor valve (5) and the water column, with the plunger at its base, starts to surface.

4. The column of water is flowed into a sump pit and when the plunger arrives at surface it actuates the closing mechanism (6) which causes motor valve (5) to close. This allows the plunger to fall back to the tubing stop (1). Thus, the well is again free of liquids and the cycle is repeated.

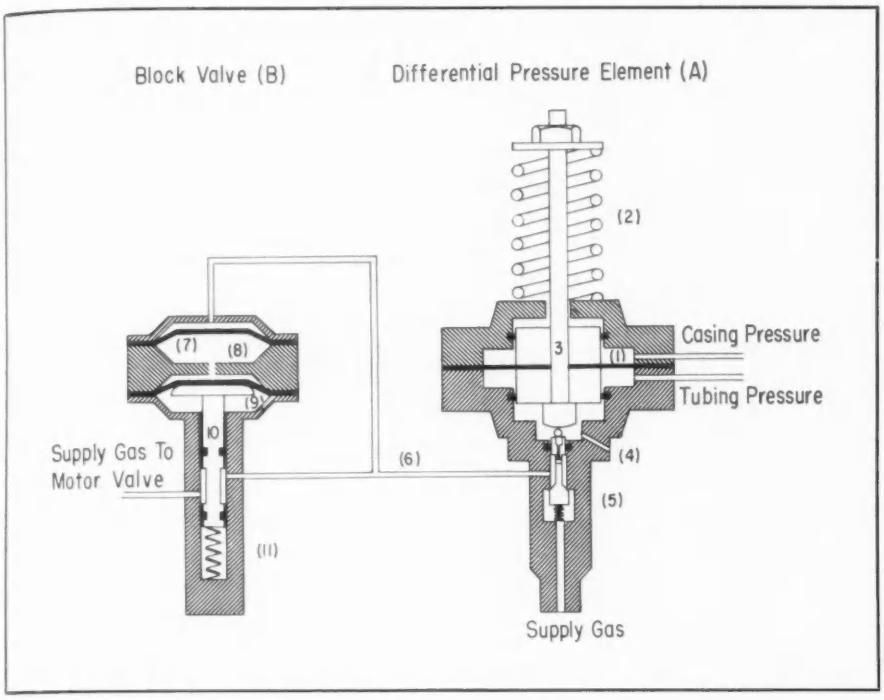


FIGURE 2—Differential pressure controller is the heart of the automatic system. When tubing pressure decreases because of water influx, casing pressure is sufficient to override combined tubing pressure and spring loading. This opens needle valve (5) and directs supply gas to the flow line motor valve which opens and unloads the well.

The closing mechanism (6) consists of a small magnetically operated valve affixed to the well tubing at the surface. Arrival of the plunger at the surface causes the valve to open. This bleeds pilot supply gas from motor valve (5), causing it to close.

From an examination of the system and the equations shown, it is evident that control is based on the amount of water entering the well and operates only as needed to remove the water. Also, it is apparent that the system is independent of fluctuations in flowing casing pressure (P_c) arising from changes in sales line pressure, since any change in (P_c) is transmitted back through the well bore causing an approximately equal change in (P_t). Whenever the casing annulus is shut-in, the system automatically ceases operation, except for the small bleed, until the well is again opened for production.

Differential controller. The controller, shown in Figure 2, consists of a differential pressure element (A) and a block valve (B). Casing pressure is applied to the top of diaphragm (1) in the differential pressure element and tubing pressure is applied to the bottom side. Spring (2) is in compression and acts in series with the tubing pressure to provide an adjustable differential pressure control.

When the combined force of the tubing pressure and the spring becomes less than the force exerted by the casing pressure, stem (3) moves downward closing valve (4) and opening valve (5). This allows supply gas to pass through the control to the ⅛-inch tee (6) where the lines divide. Supply gas flows through the lower line, through the ports in the block valve to the diaphragm on the reverse acting motor valve (Figure 1) causing it to open.

At the same time, supply gas pressure is applied to the upper diaphragm (7) in block valve (B). This forces the oil in the upper chamber to flow through a small port in plate (8) into the lower chamber. Several minutes are required to displace the oil from the upper chamber to the lower chamber. As the oil enters the lower chamber, it forces diaphragm (9) and stem (10) downward, cutting off the supply gas to the motor valve.

When the free piston reaches the surface, it trips a magnetic valve affixed to the tubing, shown as closing device (6) in Figure 1. This bleeds the supply gas off the diaphragm of the motor valve, causing it to close.

As the tubing pressure builds up, it forces stem (3) upward closing valve (5) and opening valve (4), thus bleeding supply gas from upper diaphragm (7) of block valve (B). With no pressure exerted against upper diaphragm (7), spring (11) forces lower diaphragm (9) and stem (10) upward displacing the oil from the lower chamber through plate (8) and opening the supply gas passage through the block valve, thus cocking the controller for the next cycle.

From the foregoing discussion it can be seen that the function of the block valve is to allow the tubing pressure, on low productivity wells, to build above the differential setting and prevent the controller from immediately reopening the motor valve.

Readily available conventional production equipment is used for the balance of the installation. The differential controller is the only special item required.

This article is an expanded version of a paper presented at the Water Lift Institute, Liberal, Kansas, 1960.

—**The End**

About the Author

Malcolm C. Gillis, Area Engineer with Pan American Petroleum Corporation, has been employed with the corporation since 1947. He has been engaged in various Petroleum Engineering assignments in Texas, Louisiana, Oklahoma and Kansas. For the past five years, he has been involved in drilling and producing operations in the general area of Hugoton field, Kansas. Mr. Gillis graduated from Rice University with a degree in mechanical engineering in 1947.

Drilling fluids in the Rocky Mountain area

A good mud program will:

- **Lower drilling and completion costs**
- **Lower mud materials costs**
- **Increase drilling rates**
- **Allow maximum protection for pay zones**

By Homer B. Brown, Jr., President
United Engineering Corporation
Casper, Wyo.

ECONOMIC CONSIDERATIONS have caused operators, drilling contractors and service companies to work closely in planning, analyzing and supervising drilling mud programs in the Rocky Mountain area.

Previously, operators failed to specify particular mud programs and the contractor faced the problem of bidding a well upon a general, rather than a specific program. He had little opportunity to express an opinion on the program he would recommend.

Today, the trend in detailing mud programs permits the contractor to provide a more realistic and, generally, a lower bid on drilling.

Area mud programs. The Rocky Mountain area includes the states of Colorado, Wyoming, Montana, Utah and Western Nebraska, plus the bordering Williston Basin of North and South Dakota. Mud programs are varied within this rather large area. Essentially, formation fluid pressures are normal or subnormal, and high pressure drilling problems are limited to isolated areas. Lost circulation, salt and/or anhydrite contamination and damage to sensitive pay zones present the major mud problems.

Productive formations throughout this area include strata of almost every geologic age from Cambrian to Oligocene. Structurally, the area consists of several sedimentary basins (Figure 1) varying in size and thickness of sections.

In the Wyoming area, two basic mud programs are applied.

1. The first program is for wells which test horizons above the Triassic red beds. These involve the use of native muds treated with bentonite, chemical thinners, emulsifiers, carboxymethylcellulose and oil. The possibility of lost circulation creates the necessity for low mud weights, and possible pretreatment with lost materials of the fibrous or bulky types. In localized areas, mud loss is severe and specialized materials have been necessary to overcome this problem. The sand pay zones are sensitive to damage from drilling mud filtrates and solids, and low water loss oil emulsion muds generally are used. Low solids muds have definite applications in this area.

2. The second program is for wells which drill through the anhydrite, and occasionally salt, in the Triassic and Permian formations to deeper producing horizons. Ferrochrom ligno-sulfonate, gypsum oil emulsion muds are being used extensively for these wells. Water flows and gas pressure zones present in the Green River Basin make necessary the maintaining of mud weights at from 10.5 to 19.5 pounds per gallon. The western portion of the Wind River Basin also has abnormal pressure gradients.

Most wells in the Williston Basin of Montana, North and South Dakota drill to productive zones in the Madison formation. These wells must drill shales and sandstones of Paleozoic, Tertiary, Cretaceous and Jurassic Zones, and through the massive salt, anhydrite and limestones of the Triassic, Pennsylvanian and Mississippian formations.

A low viscosity bentonite mud, with bulky type loss materials, is used to drill the surface hole. A fresh or salt water "flush water" program is used to drill to from 5,000 to 5,800 feet, at which point a saturated salt water mud is prepared. Attapulgite clay, starch, crude oil and one of the lignosulfonates is used in preparing this system. The system is maintained at a salt saturated or super saturation level by the addition of sack salt. Produced salt water generally is used for water additions.

Loss of circulation in fractured formations, and high formation pressures are the biggest problems encountered in drilling in the Uinta Basin of Colorado and Northeastern Utah. Make-up waters are poor, and some stringers of anhydrite are encountered in the Tertiary. Mud weights are maintained at a delicate balance between the maximum weight resulting in loss of circulation and the minimum weight necessary for control of formation pressures.

All types of loss materials have been tried, and numerous attempts made to drill in this area with air, gas or aerated systems. The presence of water-bearing zones and unconsolidated shale sections complicate the use of these systems. Use of barium carbonate or one of the ligno-sulfonates to overcome or treat out the anhydrite contamination encountered has proved successful. Conventional bentonite and/or chemical oil emulsion muds ordinarily are used.

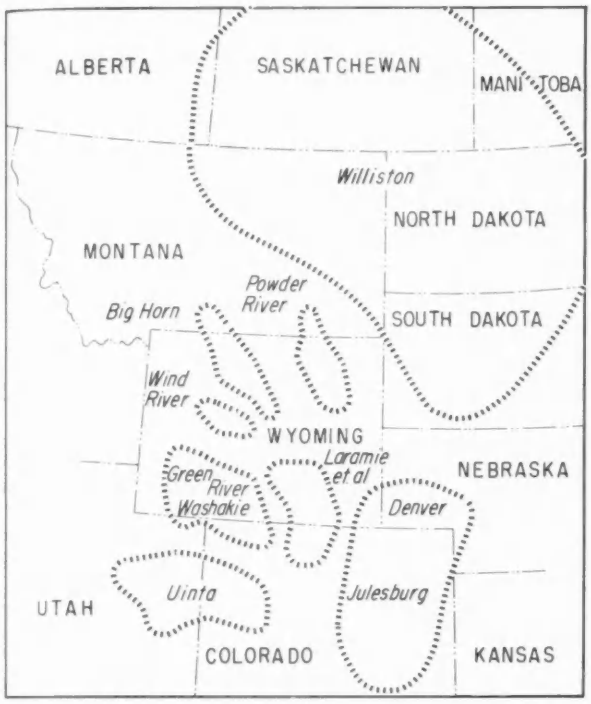


FIGURE 1—Rocky Mountain Sedimentary basins.

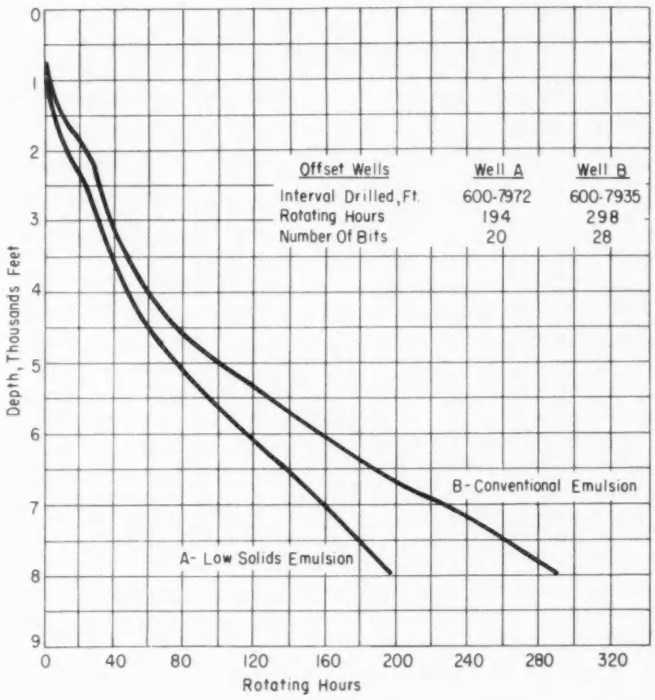


FIGURE 2—Comparison in drilling time—conventional vs. low solid emulsion muds, northern Rocky Mountains.

Wells drilled in the Lisbon Valley of southeastern Utah and western Colorado encounter massive salt zones, surface water flows and mud loss zones. Weighted muds are necessary for productive zones in and below the salt. The mud programs used are:

1. Bentonite and water muds for the surface hole. Loss of circulation should be anticipated.

2. Two programs have been used from the surface casing to near the top of the salt zones—"flush-water" native mud and low solids surfactant oil emulsion muds.

3. Saturated salt water oil emulsion muds are used from the top of the salt section. These muds may be a low solids surfactant oil emulsion mud or a conventional salt, attapulgite clay, starch and preservative system. A ligno-sulfonate is employed as an emulsifier and thinner if the latter system contains oil.

4. Some operators are drilling and completing productive zones below salt with inverted oil emulsion muds.

5. Mud weights for completion will vary from 10.0 to 14.0 pounds per gallon.

The Julesburg Basin of Colorado, western Nebraska and southeastern Wyoming has few drilling mud problems. The accepted mud program for drilling to the productive Cretaceous sand pay zones is a "flush-water" native mud to near the top of the pay zone, then preparing a lignitic oil emulsion mud treated with carboxymethylcellulose. Few wells have been drilled through the anhydrite-contaminated red bed section and these use a lingno-sulfonate gyp mud. The Cretaceous sand pays are very sensitive to damage from drilling mud filtrates and solids.

RECOMMENDED MUD PROGRAM

A proper mud program provides these advantages:

- Lower drilling and completion costs.
- More efficient use of contractor rig and equipment to drill a fast, safe hole.
- Maximum protection afforded pay zones.
- Lower mud materials costs, consistent with safe operations.

Low solids muds. Low solids mud systems have the advantages of substantial increases in bit life and penetration rate at approximately the same cost as for conventional oil-in-water emulsion muds. Less pump wear and improved fluid hydraulics also are noted. This type system has low thixotropic properties and some difficulty may be noted in extremely troublesome shale areas. Successful applications of these systems have been observed with muds weighted to approximately 15 pounds per gallon.

Types of low solids muds used in the Rocky Mountain area have been as follows:

- Blended anionic-nonionic liquid surfactant emulsifier, which has been the most noticeable trend. This system is prepared easily by adding oil and emulsifier directly to water in the surface tanks or to water circulating in a casing string. A volume of 5 to 10 percent diesel oil and 2 gallons of surfactant emulsifier is added at the same time to the water. The viscosity is adjusted to from 28 to 34 seconds per quart funnel viscosity by adding high viscosity sodium carboxymethylcellulose and bentonite in a ratio of 50 pounds of the former to 300-500 pounds of bentonite.

Carboxymethylcellulose provides the necessary filtrate control at 6 to 10 cc API. The solids content will vary from 2 to 10 volume percent. Oil is added, in a maintenance program, as determined by distillation, to maintain a concentration of from 5 to 10 volume percent. One and one-half gallons of the emulsifier is added with each barrel of oil added. Viscosity and water loss is controlled by carboxymethylcellulose and bentonite additions. Conventional thinners may be used as necessary. Figures 2, 3 and 4 show drilling time for wells drilled

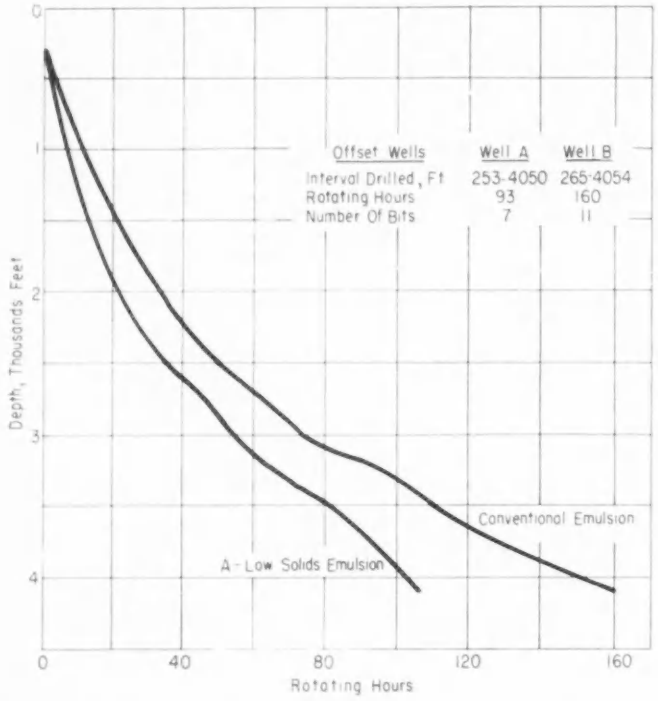


FIGURE 3—Comparison in drilling time—conventional vs. low solids emulsion muds, southern Rocky Mountains.

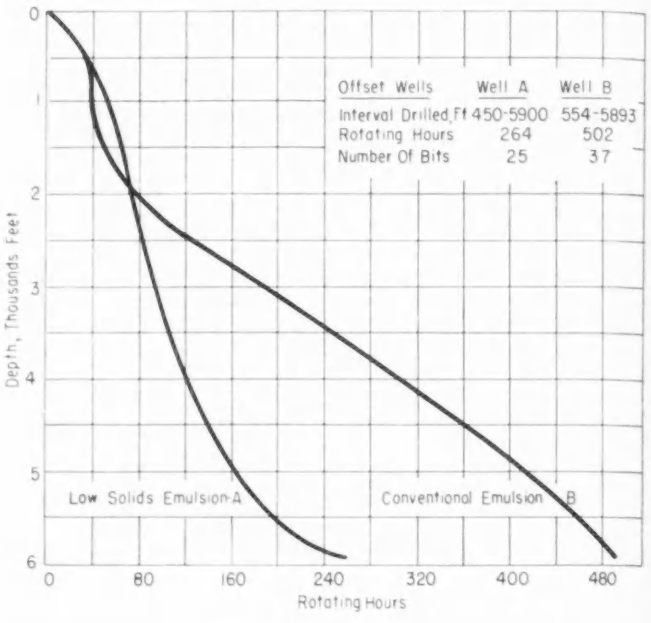


FIGURE 4—Comparison in drilling time—conventional vs. low solids emulsion muds, central Rocky Mountains.

with this system and offset wells drilled with a conventional o/w emulsion mud system.

- Some operators are using the same system as described above, without the surfactant emulsifier. Conventional thinners are used in this system.
- The use of guar gums is being considered at this time. This sype of system is prepared as follows:

Fresh or salt water
Gum, pound per barrel. .0.5 to 1.0
Starch, pounds
per barrel .....1.0 to 2.0
Preservative, pounds
per barrel .....0.3 to 0.5
Corrosion Inhibitor,
pounds per barrel..... 0.5
Oil, %/vol ..... 0 to 20.0

The gum also acts as a flocculating agent, and solids are maintained at from 1.0 to 4.0 percent by volume.

TABLE 1—Characteristics of Mud Systems

	Low Solids o/w Emulsion	Ligno-sulfonate Gyp Emulsion	Gyp Base
Weight, ppg	8.45	9.5	9.5
Viocosity, sect/qt.	32	50	50
Viocosity, cpe	7	22	33
Plastic Viscosity, cpe	5	18	21
Yield Value, lbs/100 sq. ft.	4	8	24
Gel Strength Initial, gms.	0	0	30
Gel Strength, 10 min, gms.	0	4	35
Filtrate, cc API	5.2	6.0	6.0
Filter Cake	Stain	2	2+
pH	8.6	9.2	7.0
Oil Content, Percent/Volume	6.0	8.0	8.0
Solids Content, Percent/Volume	3.0	12.0	15.0
Preservative, lbs/bbl.	0	0	0.40
Excess CaSO4, lbs/bbl.	0	2.5	2.5
Hydroxyl, epm	0	0	0
Carbonate, epm	1.2	2	4
Bicarbonate, epm	1.2	8	8
Total Hardness, ppm	180	1200	1200

Inverted oil emulsion muds. A definite trend is noted in the use of inverted oil emulsion muds. Essentially, these systems have been used as completion and work-over fluids, although wells have been drilled in the Williston Basin, Green River Basin and the Lisbon Valley with these muds.

The external phase generally is diesel oil, which makes up from 50 to 65 percent by volume of the total system. A previously prepared sodium chloride water is added to the oil, after the inverting agents have been added. Slight variations in the inverting and the stabilizing emulsifiers are made, dependent upon bottom hole temperature and the desired mud weight. Mud weights vary from 7.9 to 19.8 pounds per gallon. Funnel viscosity ranges from 45 seconds per quart upward. The fluid loss will be oil, and will be zero at 100 psi and 70° F.

Ligno-sulfonate muds. Ferrochrome ligno-sulfonate muds are used generally throughout the area. Applications have been most successful when drilling through areas anhydrite and/or salt contaminations. Usage has been noted also in areas where the make-up water is poor, and in some cases, in fresh water uncontaminated systems.

When drilling in areas of anhydrite and/or salt contamination, the fresh water chemically-treated mud is converted to an oil emulsion mud by the addition of from 2 to 4 pounds per barrel of a ferrochrome ligno-sulfonate, 6 to 15 volume percent crude or diesel oil, and caustic soda to adjust the pH to 9.2. Two to 4 pounds per barrel gypsum (calcium sulphate) also may be used prior to drilling into the anhydrite zones. Carboxmethylcellulose can be used for water loss control at from 6 to 10 cc API. Starch and preservatives may be used for

additional filtrate control. Aluminum stearate or other type defoamers will be used if foaming occurs due to chemical overtreatment or due to drop in pH value. Table 1 shows chart of mud properties.

Use of other types of ligno-sulfonate muds has decreased since the above program has proven economical, and to have such widespread application.

Inhibited systems. Laboratory studies have been made on shale stabilization type mud systems, and a few field tests have been conducted in the Rocky Mountains. Field performances and cost factors have not indicated any great application of these inhibited systems in the area.

Proper environment for shale control would be a system having a high filtrate calcium level, plus controlled alkalinity. The problem was to incorporate this high calcium, controlled alkalinity environment into a fluid which would possess satisfactory physical properties for use as a drilling fluid, and which could be maintained over long periods of time while drilling under a wide variety of conditions. Maintenance of these systems is determined by chemical analyses of the mud and the filtrate to make certain that the proper chemical relations are being maintained to insure the desired shale reactions.

Flocculating agents. In areas where "flush-water" low weight native muds are being used to drill the Cretaceous shales and bentonites, several operators have been using flocculating agents or solids rejector type chemicals to cause flocculating and settling of drilled solids. Use of these materials in low concentrations results in savings in water, longer bit life and increased penetration rate. This provides a low solids flush-water mud program for top hole drilling.

Surface active emulsifiers. Use of anionic or amine liquid surface active emulsifiers in conventional oil-in-water type emulsions has been used successfully in areas where low solids muds have little application, and especially where the mud systems are weighted to 11.0 pounds per gallon or above. This type system is prepared by the addition of from 6 to 12 volume percent crude or diesel oil to a chemically treated mud system. The emulsifier is used in a ratio of from 0.5 to 1.0 volume percent of the total final mud system.

Filtrate from this type system will retain low surface tension properties in a range of from 34 to 40 dynes per centimeter. Low water loss and surface tension property of the filtrate provides additional protection for pay zones which contain bentonite and clayey matrix materials. Also, completion problems seem to be decreased when this type system is used.

Air and aerated systems. Improvement in air drilling equipment and availability, plus increased experience in air drilling and use of aerated mud systems, has provided an incentive for operators to give additional consideration to this drilling method. Use of foaming agents and corrosion inhibitors permits more general usage in areas where relatively high volume water flows are present. The greatest concentration of air and/or gas drilling has been in Western Colorado and Utah. —**The End**

About the Author

Homer B. Brown, Jr., is president of United Engineering Corporation and United Drilling Fluids, Inc., Casper, Wyo. After graduation from the University of Oklahoma with a B.S. degree in petroleum engineering, he worked as a petroleum engineer on the Canol Project in Canada as a drilling and service engineer in the Rocky Mountains area with Baroid, and as service engineer, chief engineer and Rocky Mountains division manager for Mud Control Laboratories. He then was employed as sales manager and division manager with Mountain and Northern Mud (Magcobar). He has been in his present position since April 1958.

Index maps aid air/gas drilling operations

Continued from Page 69

in a statistical index which accompanies the map. The index additionally provides data as to location of each well, operator, well name, interval and geologic formation air/gas drilled, hole size, reasons for using air/gas, drilling fluid and completion date.

Fields in which air or gas drilling was applied in development wells are represented on the map by a few typical well locations. An example is the San Juan Basin located in northwestern New Mexico which has a long and successful history of air/gas drilling applied principally for reasons of completion technique or formation evaluation.

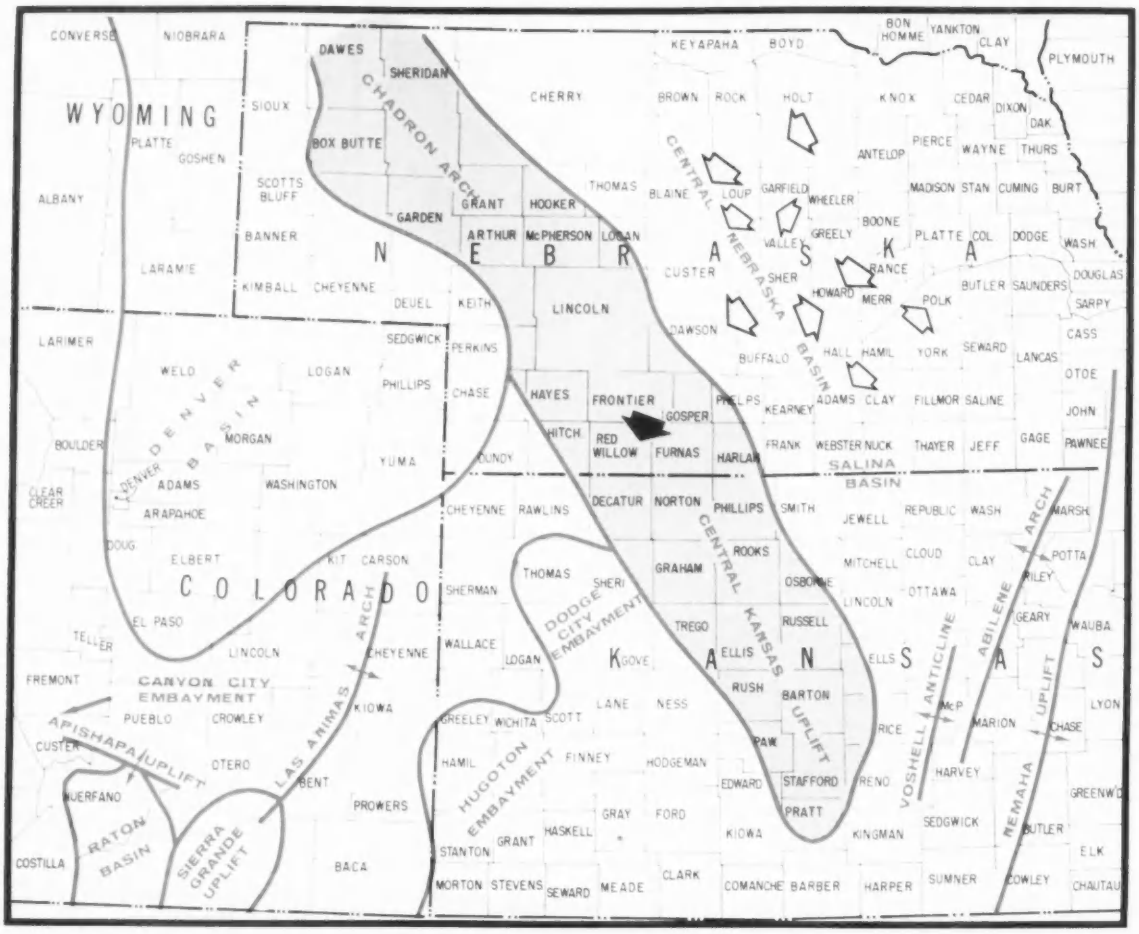
This new index map approach to the study and application of air/gas drilling may set a pattern for similar studies in other geologic provinces.

Table 1 presents the relative number of different air/gas applications shown as percentages of the total successful air/gas drilling operations in the various Rocky Mountain sedimentary basins. Such information extracted from the index map and supplemented by details from the statistical index provides important information to be considered when programing exploratory and development wells. It points out the basins where lost circulation problems exist and have been successfully overcome by the application of air/gas techniques; the map permits exact identification of such areas in each basin.

In like manner areas can be identified where economics in well drilling costs have been achieved through improvements in penetration rates and reduction of bit costs by using air/gas. Similarly areas are identifiable where formation evaluation and completion techniques have been improved through the adoption of air/gas drilling. An important consideration in deciding on the possible application of air/gas is the number and identification of geologic formations in which air drilling was successful. The right hand column in Table 1 highlights these details.

ACKNOWLEDGMENT

Index Map and information contained in this article furnished by O. E. Mechem, vice president, Drilling Analysis Service Co., Denver.



Central Nebraska Basin is the locale of a series of rank exploratory tests staked in Adams, Blaine, Dawson, Garfield, Greely, Holt, Loup and Polk counties (open arrows). Nearest production lies in the new Sleepy Hollow field of Red Willow County indicated by solid arrow.

Central Nebraska oil play gains momentum

Independents step up activity to test Paleozoic beds in nine Nebraska counties

By Joseph A. Kornfeld, President
Kornfeld International, Tulsa

A NEW WAVE OF WILDCATTING is underway in the Central Nebraska Basin. The drilling campaign, covering more than 25,000 square miles, is an offshoot of a series of successful discoveries by a group of independents in nearby Red Willow County flanking the Cambridge Arch (WORLD OIL, August 1960, pp. 78-81).

Only six months after the discovery well was completed, Red Willow County's Sleepy Hollow field has more than 53 producing oil wells from four Kansas City limestone reservoirs, the Lamotte (Reagan) sandstone and the granite wash.

Paleozoic beds are now being tested in nine counties scattered over the central portion of the state by a group of independents who are searching for the new, low-cost reserves at depths under 5,000 feet.

Area described. Reed[1] defines the Central Nebraska Basin as that portion lying east of the Cambridge-Chadron arch and west of the Table Rock arch (Neamaha granite ridge), where Permian, Pennsylvanian and pre-Pennsylvanian formations are present.

He observes that the Central Nebraska Basin is a northward extension of the Salina Basin. Also, the distribution of Cambrian to Mississippian rocks of the Lower Paleozoic indicates a connection between the Forest City Basin of southeastern Nebraska and the Central Nebraska Basin through southwestern Iowa and northwestern Missouri.

Drilling on the Cambridge Arch

Editor's note: Murfin Drilling Company drilled the Sleepy Hollow discovery east of McCook in Red Willow County, Nebraska, last summer, and has seen the field mushroom to 53 producing oil wells by February 1, 1961 —from four zones in the Lansing-Kansas City, the Lamotte (Reagan) sandstone and the granite wash.

Murfin operates three rigs in the area. Rock Island is considering looping its line to the field to take care of the new completions. Pubco has two dual completions and more are planned.

In this exclusive interview, Fred Murfin, president of Murfin drilling company explains drilling procedures in the Mid-Continent's hottest oil play.

Q *Mr. Murfin, what is the profitability outlook for an independent contractor in this new area?*

A Out-of-state rigs move in weekly, cutting contract prices as rigs outnumber holes to be drilled. There were very few trucking contractors in the area until recently. However, three new contractors have moved in and are handling the job well.

Q *What is your toughest drilling problem at Sleepy Hollow?*

A Lost circulation. Circulation might be lost at depths ranging from 700 feet and below, with mud costing up to $1,000 per well.

Q *How do you restore circulation?*

A We use conventional lost-circulation materials such as cottonseed hulls, flaking materials and special mud additives. We usually run about three sacks of flake and five sacks of cottonseed hulls per lost zone. However, each lost-circulation job varies.

Q *What mud program do you use?*

A We start mudding up at 2,500 feet, and use a 9.5-10 ppg, 45 sec. viscosity bentonitic low pH mud with a 5 cc or under water loss.

Q *Do you have difficulty in maintaining straight hole?*

A No. The maximum bore-hole deviation permitted in the drilling contract is 1½ degrees.

Q *What is your drilling, casing and cementing program for the Sleepy Hollow field?*

A On 3,600-foot drilling contracts, surface pipe consists of 8⅝-inch casing set in 12¼-inch hole. The 5-inch production string is set in 7⅞-inch hole. We use 200 sacks to cement the surface string at 273 feet and 175 sacks for the production string at 3,600 feet.

Q *What are the footage costs?*

A Currently, footage rates are quoted at $2.65, and may be cheaper.

Q *How many days does it take to drill beneath the surface shoe?*

A About seven days.

Q *What completion method is used at Sleepy Hollow?*

A Most completions are set-through the pay zone and selectively perforated.

Q *How many contract drilling rigs are operating at Sleepy Hollow?*

A There are seven. We have three operating for Pubco Petroleum Company. K & E Drilling Company and Lewis Drilling Company have one rig each working for Midwest Oil Corporation. Mast Drilling Company has one rig operating for M. W. Volentine, as does Love-Miller Drilling for The Ohio Oil Company.

Depth to basement. Throughout the Central Nebraska Basin, the entire Paleozoic section can be penetrated and the pre-Cambrian encountered at 5,000 feet or less. The basement complex can be reached as shallow as 3,500 feet over the Cambridge-Chadron arch on the west to as shallow as about 500 feet on the east, on the Table-Rock anticline.

Major objectives sought. Among the major exploratory targets will be formations of Paleozoic age ranging from Lamotte (Reagan) sandstone of Upper Cambrian age, through the entire Arbuckle section of Cambro-Ordovician age, Silurian, Devonian, Mississippian and particularly Lower Pennsylvanian sediments comprising the Lansing-Kansas City limestones which are well developed throughout the basin, but thin over the several uplifts bordering the basin.

Particularly, the Lamotte sandstone which produces in the Sleepy Hollow field in eastern Red Willow County on the western flank of the Cambridge arch will be sought similarly high on the eastern flank of the arch.

The Cambro-Ordovician Arbuckle rocks also mark an important exploration target in the Central Nebraska Basin and hold a highly respectable production position to the south on the Central Kansas uplift.

LITERATURE CITED

[1] Reed, E. C., "Central Nebraska has possibilities," WORLD OIL, Nov. 1954, p. 113.

BIBLIOGRAPHY

Bartram, John G., W. C. Imbt and E. F. Shea, "Oil and Gas in Arbuckle and Ellenburger formations, Mid-Continent region," AAPG *Bulletin*, Vol. 34, No. 4, p. 682 (1950).

Tapp, S. C., "Where is the oil in Nebraska's Salina basin?" *Oil and Gas Journal*, Vol. 57, No. 1, p. 152 (1959).

In Northeast New Mexico. . .

Mobile magnetometer gives rapid regional coverage

Truck-mounted tool intermediate in detail, speed between airborne and manual surveys

By Walter E. Heinrichs, Jr.
President and General Manager
Heinrichs Geoexploration
Company, Tucson, Ariz.

WHERE DETAILED magnetic coverage is required on a regional basis, the mobile, truck-mounted magnetometer has proven a practical exploration tool. Since the mobile magnetometer was introduced in 1952, many long trips have been made between various job areas and headquarters. Especially on open highways, it has been found useful and practical to acquire magnetic records for broad regional correlation purposes.

An example of results of such a trip on U.S. highways 54 and 60 from the Texas-New Mexico border to Lucy, N. M., in central Torrance County, is shown in Figure 2. This area was selected because of its potential interest and relative familiarity to the petroleum industry. The resulting profile is about 190 miles long, looking essentially north from Lucy to Vaughn and northwesterly from Vaughn across Guadalupe and Quay counties to the Texas border.

Instrumentation. The magnetometer used is a modified flux-gate type. Motion and magnetic effects from the truck mount are minimized by placing detecting and orienting elements in a head at the end of a tapered, 20-foot long glass fiber boom. Remaining effects are further compensated with small permanent magnets and hydraulic shock mounting. The resultant record, completed in five hours at an average speed of about 40 mph is a continuous trace of the relative total magnetic intensity, plotted on a continuous graph chart six inches wide at a scale proportionate to the distance traveled by the vehicle.

Magnetic data. Raw records were reduced to scale and were originally plotted at 200 gammas per inch vertically and 8 miles per inch horizontally. No corrections were made nor considered necessary because all pertinent extraneous effects were believed to be very minor or gradual. Topographic elevations vary from 6,200 feet on the west end of the profile, and gradually downgrade to 4,000 feet on the east end.

Except for occasional localized near-surface or artificial effects, the record was smooth and gradual.

Maximum gradient encountered was about 25 gammas per 100 feet. This gradient was measured on the highway north of Pedernal on the Santa Fe railroad, 4½ miles west of Encino, N.M.

Magnetic variation was from 1,200 gammas maximum over the pre-Cambrian complex area immediately east

This article emphasizes the current trend towards emphasis on the less expensive geophysical tools and methods and on the coordination of geological and geophysical data. It should also be noted that USGS maps provide geophysical coverage, serving as a comparison to the subject magnetic profile.

Such reconnaissance geophysical profiles are bound to become more popular as exploration increases in remote intermontane basins in the western United States.

of Lucy to a low of 100 gammas centered just east of Vaughn. Northeast from Vaughn, the profile generally shows a gradual rise to the east to about 1,000 gammas, with possibly a slight leveling-off tendency on the extreme east end (at the Texas border).

Contoured aerial magnetic data between Vaughn and Cuervo presented on United States Geological Survey geophysical maps 16, 17 and 18 (1950) correlate precisely with the mobile magnetometer data. The exceptions are effects due to differences in exact ground positioning. Greater detail was recorded because the truck-mounted instrument was closer to the magnetic "source."

Interpretation. A broad low at Vaughn suggests the deepest, thickest section of sediments along the profile in this area, reflecting the northwest extension of the Midland Basin. Local higher frequency oscillations east of Encino westward are due to exposed basalt; the over-all gradual rise is due to the approaching effects (farther west) of the pre-Cambrian granite-schist-quartzite complex which outcrops between Pedernal and Lucy.

This pre-Cambrian mass appears to be a southward extension of the Sangre de Cristo Uplift. The abrupt rise westward from Pedernal is due to this mass and associated major normal fault displacement along its eastern margin; this also represents the boundary between the Midland Basin and the Sangre de Cristo Uplift. Similar faulting is also suggested on the west side of the pre-Cambrian mass near Lucy.

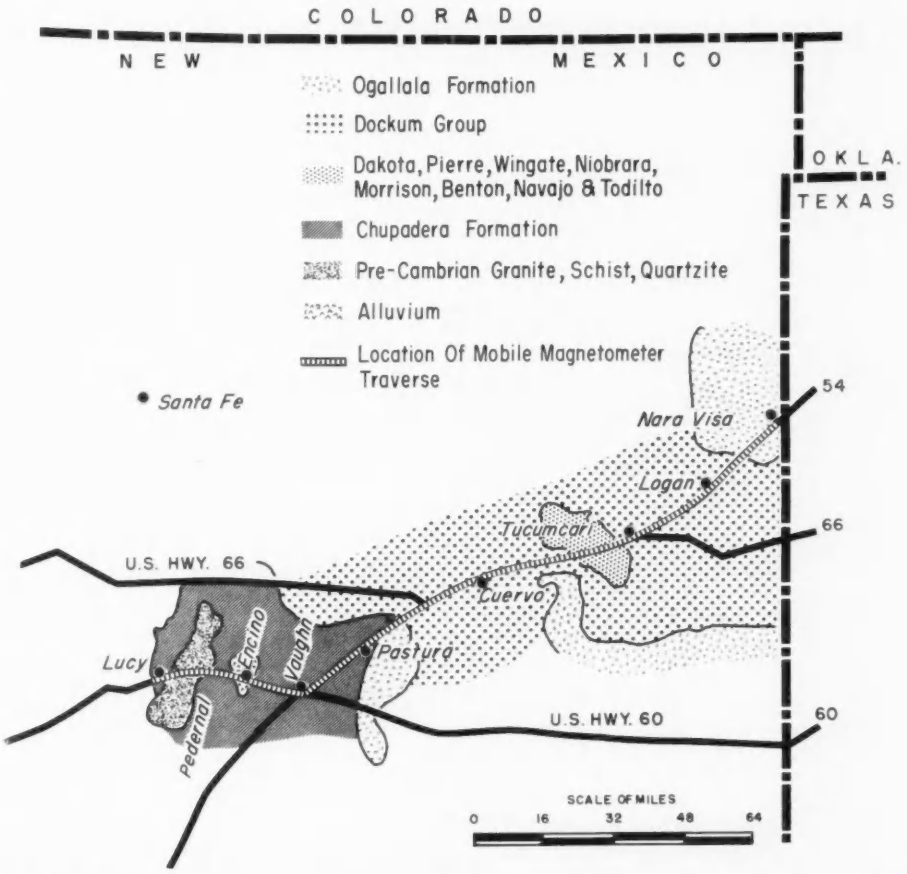


FIGURE 1—Map of northeastern New Mexico shows (in hachures) route of mobile magnetometer profile survey. Surface geology is also shown, based on U.S.G.S. map by Darton (1928).

Otherwise, the general high zone and more rapidly fluctuating gradients are caused by a greater concentration of magnetite and by variations within the mass itself.

The gradual rise going northeast from Vaughn to the eastern end of the profile may be due in part to normal regional effects and/or deep-seated basement effects related to the Amarillo Uplift further northeastward.

Without benefit of detailed study and field correlation, several more local highs and their associated lows could be related to sedimentary structure in addition to possible basement effects.

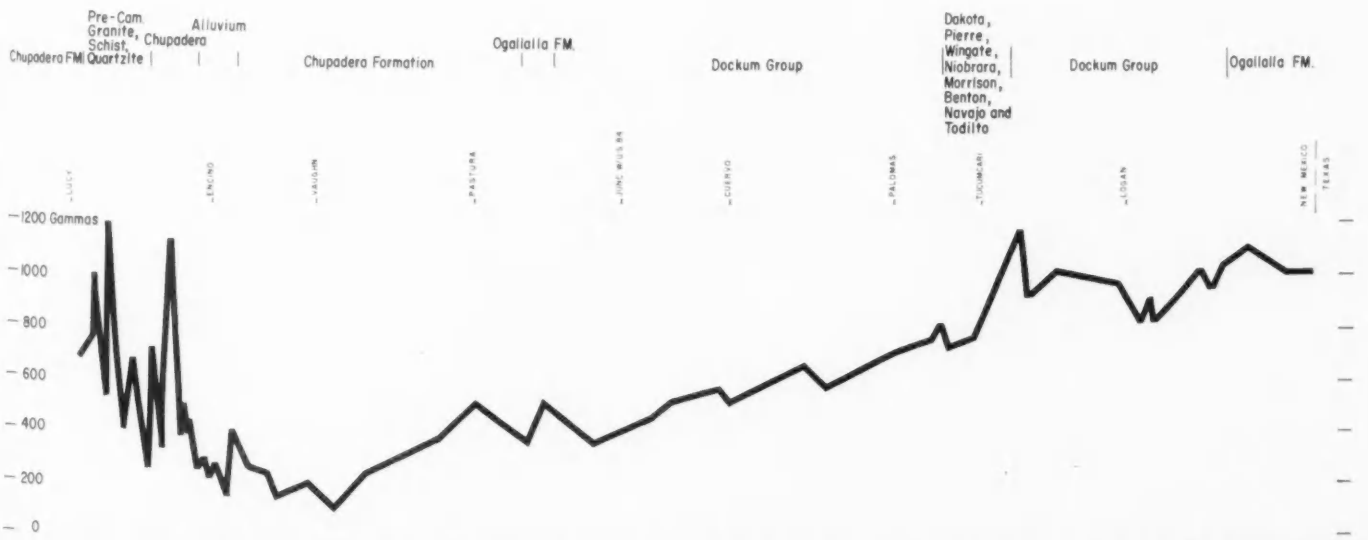


FIGURE 2—This is the total intensity magnetic profile made with the truck-mounted magnetometer along U.S. highways 54, 60, and 66 from the Texas state line on the east to Lucy, N. M., on the west. The profile covers about 190 highway miles. Some local geological features are indicated. The traverse took about five hours at an average speed of about 40 mph.

FIGURE 3—Detector head of mobile magnetometer extends from vehicle in recording position. Inset shows instrument panel.

In particular, these are the high at Pastura and the low-high-low immediately northeast of Pastura. The smaller flexures in the area from Cuervo to just west of Tucumcari appear to be more related to formational change and faulting, either in the sediments and/or in the basement.

Northeast from Tucumcari, the sharp high-low, followed by a broad high-low-high near the Texas border, all suggest basement and/or sedimentary structural effects. This zone, located approximately between Logan and Tucumcari, and to a lesser degree, the zone between Santa Rosa and Pastura are the two most pronounced reversals from the normal or regional gradient, likely reflecting important potential local or regional trends in the sediments.

The profile correlates with previously published aero-magnetic coverage of part of the area traversed and also shows a remarkable correlation with the exposed regional geology.

About the Author

Walter E. Heinrichs, Jr., has been president and general manager of Heinrichs Geoexploration Co., Tucson, Ariz., since August, 1958. After graduating from Colorado School of Mines in 1940, as a geological engineer with a major in geophysics, Heinrichs did seismograph work with National Geophysical Co. and Seismograph Service Corp. After becoming a line officer in the United States Naval Reserve, he served in airborne magnetometer development and in Naval Petroleum Reserve No. 4 (Northern Alaska) as a field geologist. Since World War II he has served as chief geophysicist, Newmont Mining Corporation in New York City, 1947-49; as exploration manager for United Geophysical Company, Inc., 1949-54, and with Minerals Exploration Company (of California), 1954-58. His petroleum and/or mining experience includes work in most of the geological provinces of the U.S. Heinrichs is a member of AIME and SEG, and is a registered engineer in both Arizona and Colorado.

BIBLIOGRAPHY

Andreasen, G. E., Kane, M. F., and Zietz, Isidore, "Aeromagnetic and Gravity Studies of the pre-Cambrian in northeastern New Mexico." Program abstract, Thirtieth Annual International Meeting, Society of Exploration Geophysicists, Galveston, Texas, November 7-10, 1960.

Baltz, Elmer H. and Read, Charles B., "Rocks of Mississippian and probable Devonian age in Sangre de Cristo Mountains, New Mexico," The American Association of Petroleum Geologists *Bulletin* 44, No. 11, 1749-1774 (1960).

Industry earnings recovering after three years of trouble

Results improved some in third quarter of 1960 and more in fourth quarter. Increases in profits in first quarter of 1961 seem assured

By L. J. Logan
Associate Editor, WORLD OIL

OIL COMPANIES have been encouraged by a definite improvement in their earning power since the middle of 1960. The third quarter brought some improvement. Fourth quarter profits were up materially over one year previously.

In the first quarter of 1961 a year-to-year increase of about 10 to 15 percent is anticipated. The second quarter of 1961 also should be more profitable than the like period of 1960. The year 1961 as a whole also may show a gain of at least 10 or 15 percent, though the latter half will be comparing with a good closing half of 1960.

The present improved earnings situation has developed only after a three-year let-down of the industry's fortunes. From mid-1957, following the Suez crisis, until mid-1960 the industry had to cope with business recession, lagging demand for petroleum, surplus oils, and weakened markets and prices. Finally, at the middle of last year, after protracted application of controls on imports and domestic crude production, prices of petroleum products and crude oil steadied and began to improve. Product prices have improved further in recent months, making better earnings possible.

If industry earnings are to continue favorable, as hoped for, it will be necessary for product prices to hold at lately improved levels or possibly to improve further. The industry will be aided to some extent by a moderate increase of about 3 percent in demand for petroleum in 1961. But in addition, the industry will need the steady or increased prices. For an increase in revenue will be necessary to cover the raises in wages and salaries throughout the industry at the beginning of 1961.

For some companies, the increases in annual wage payments will be equivalent to about 10 percent of profits in 1960. About 10 percent more net income than in 1960 must be generated in 1961 merely to pay the wage raises and keep net profits undiminished. To accomplish that and further increase net profits, as desired, will require not only the expected small increases in volumes of business but also good markets and prices. An increase in earnings in the first quarter of 1961 seems well assured. But there is less certainty about increases thereafter, particularly after mid-year.

Factors which aided earnings in 1960 included: a 2.3 percent increase in petroleum demand, improvement in product prices, growth in sales of petrochemicals, more revenue from natural gas, and cost cutting programs. Similar factors will aid oil companies also in 1961, though such advantages will be partially offset by increases in wage costs.

Earnings of 26 companies were 17 percent higher in the fourth quarter of 1960 than in the final quarter of 1959, as shown in the table herewith. Eighteen of the companies did better and 8 not as well. The same 26 companies reported 8.3 percent more profit in 1960 than in 1959. Twenty firms had increases, but 6 did not do as well.

Net Earnings of Some Oil Companies in 4th Quarter and Year, 1960 vs. 1959

(All "per share" data are based on the number of shares of common stock outstanding Dec. 31, 1960)

	4TH QUARTER					YEAR				
	$ Thousand		$ Per Share		%	$ Thousand		$ Per Share		%
COMPANY	1960	1959	1960	1959	Diff.	1960	1959	1960	1959	Diff.
Ashland O. & R.	3,906	3,627	.56	.53	+ 8	15,206	14,744	2.17	2.10	+ 3
Atlantic Ref. Co.	19,161	4,745	2.08	.49	+304	46,566	30,174	5.00	3.19	+54
Champlin O. & R.	3,009	2,403	.71	.57	+ 25	9,157	8,548	2.14	2.00	+ 7
Colorado O. & G.	1,212	762	.34	.20	+ 59	1,850	2,527	.42	.63	— 27
Continental Oil	15,765	14,970	.75	.71	+ 5	61,200	60,300	2.90	2.85	+ 2
Delhi-Taylor	550	d23	.11	d.01	.....	3,600	2,707	.70	.51	+33
Gulf Oil Corp.	92,090	73,992	.89	.72	+ 24	330,000	290,467	3.20	2.82	+14
*Imperial Oil	14,244	16,720	.45	.53	— 15	61,000	54,525	1.94	1.73	+12
*International Pet.	7,200	8,100	.49	.56	— 11	30,000	23,900	2.06	1.64	+26
Ohio Oil Co.	11,805	11,310	.85	.82	+ 4	39,215	38,633	2.84	2.80	+ 2
Phillips Pet. Co.	33,480	27,253	.97	.79	+ 23	112,400	104,639	3.27	3.05	+ 7
Plymouth Oil Co.	d2,147	d610	d.79	d.22	.....	d2,446	d2,186	d.90	.80	.....
Shell Oil Co.	40,272	43,362	.66	.72	— 7	144,580	147,418	2.39	2.43	— 2
Signal O. & G.	4,540	3,725	.46	.38	+ 22	16,500	16,250	1.67	1.64	+ 2
Sinclair Oil Corp.	17,896	10,429	1.16	.68	+ 72	52,400	45,000	3.41	2.93	+16
Socony Mobil	46,600	40,952	.96	.84	+ 14	182,500	163,952	3.76	3.38	+11
Standard, Calif.	66,745	73,484	1.06	1.16	— 9	266,000	253,599	4.21	4.01	+ 5
Standard, Ind.	41,924	33,408	1.17	.93	+ 25	144,750	139,597	4.05	3.90	+ 4
Standard, Ky.	2,344	3,543	.90	1.36	— 34	12,792	14,726	4.91	5.65	—13
Standard, N.J.	187,000	153,000	.86	.71	+ 22	688,000	630,000	3.18	2.91	+ 9
Standard, Ohio	7,088	7,102	1.43	1.43	.....	24,662	25,061	4.94	5.02	— 2
Sunray Mid.-C.	12,043	13,032	.62	.68	— 8	41,121	43,815	2.10	2.25	— 6
Sun Oil Co.	14,421	10,693	1.11	.82	+ 35	49,273	42,844	3.78	3.28	+15
Texaco Inc.	112,766	92,492	1.83	1.50	+ 22	391,750	354,346	6.34	5.74	+11
Texas Gulf Prod.	983	1,310	.25	.33	— 25	4,400	4,189	1.10	1.04	+ 5
Texas Pac. C. & O.	2,019	2,014	.52	.52	.....	7,778	7,197	2.00	1.85	+ 8
Tidewater Oil	3,649	6,109	.21	.37	— 40	35,000	33,941	2.22	2.13	+ 3
Union Oil, Calif.	10,679	7,615	1.23	.87	+ 40	34,400	27,515	3.95	3.16	+25
*Total 26 Companies	749,800	640,699	.....	.....	+ 17	2,712,654	2,504,375	.....	.....	+ 8

* Imperial and International are excluded from totals, being included as affiliates of Standard, N.J.
d. Deficit.

Where does oil stand in the cost-allowable-price squeeze?

Integrated companies have good chance to improve earnings; operators depending on production face dim future; suppliers, manufacturers and drilling contractors still caught in middle

By WORLD OIL Staff

THE U.S. OIL INDUSTRY'S economic picture can be summed up in three statements.

1. The outlook is bright for integrated oil companies. They have a good chance to improve their earnings through income from petrochemicals, refining, pipe lines and in some instances from overseas operations (See Page 85).

2. The outlook is not so bright for the operator whose income depends primarily on crude oil production.

3. Equipment manufacturers, suppliers and drilling contractors will continue to be caught in the middle.

The promising economic position of integrated companies is reflected in the latest Value Line Investment Survey:

"After sagging for a disheartening 18 months, oil company profit margins made a dramatic turn in the middle of 1960 and have now reached the best level in more than three years:

"The oil group's third quarter 1960 earnings showing was good. The fourth quarter reports were excellent. The first quarter 1961—thanks to Mother Nature—will be stupendous. In the face of a serious business recession, oil companies are posting a strongly rising profits trend which seems sure to continue through the middle of this year (1961)."

Crude oil operators show a different picture. To obtain earnings reports of the thousands of independent crude oil producers is virtually impossible. However, there are some indicators which show their changing economic position.

- During 1960, independent operators accounted for about 37.2 percent of U.S. crude oil production, compared with 37.9 percent in 1955.

- In 1958, independents drilled 77.5 percent of all U.S. wells, then dropped to 74.9 percent in 1959, and an early estimate of 74 percent or less during 1960.

- The Independent Petroleum Association of America reports 404 membership cancellations between 1956 and 1960, due to mergers, bankruptcies and liquidations. According to the Association, there has been no comparable period in which the number has been so high.

- After increasing about 5 percent per year to a peak of 7,000 in 1957, membership in the Texas Independent Producers and Royalty Owners Association began a steady decline to about 6,500 in 1961. TIPRO reports that by far the majority of the 500 drop-outs said they had to cancel their memberships because they couldn't afford to pay their dues. Reasons: reduced profits resulting from low allowables, increasing costs and inadequate crude oil prices.

Production income dwindles. There are more independent producers in Texas than in all other states combined. They account for about 52 percent of the state's crude oil production.

Thus, the trends in income from Texas production pretty well reflect the independents' economic position in recent years. In 1956, the Texas oil industry earned $2.96 billion, then jumped to $3.26 billion in the abnormal (Suez Crisis) year of 1957.

Steadily declining allowables and prices dropped the total 14.5 percent to $2.79 billion during the recession year of 1958. Then, after recovering 5 percent to $2.96 billion in 1959, the total dropped 8.7 percent to $2.67 billion last year. Forecasts are that Texas' production income will decrease another 2 percent to $2.62 billion during 1961.

The "in-betweeners". Caught in the middle of this varied economic mixture are the drilling contractors, equipment manufacturers and suppliers.

The drilling contractors' problems are well known. U.S. operators reported 46,778 new well completions during 1960, down 3,401 wells or 6.8 percent from the previous year—and 11,340 wells less than the peak year of 1956.

The four-year decline in annual well completions dropped the 1960 total to the lowest level since 1952. It is predicted that 1.5 percent, or 699 fewer wells will be completed this year.

An average of 3,543 rigs was reported operating monthly last year, the lowest since the days of drastic government limitations during World War II. Little or no improvement was reported during the first quarter of 1961.

Government surveys of 365 companies show that the value of shipments of oil, gas and water well drilling and production equipment dropped 18 percent between 1957 and 1959—from $1.2 billion to $954 million.

Spot checks by the U.S. Department of Commerce indicate that shipment values fell another 10 percent during 1960. However, a steady increase in equipment sales is expected this year.

What is the answer? Colonel Alvin C. Hope, president of the Independent Petroleum Association of America says an upward adjustment of at least 25 cents per barrel in crude oil prices is necessary if the domestic oil producing industry is to remain solvent.

Cumulative wage increases absorbed by the industry since 1957 have been the equivalent of 11 cents per barrel of crude oil produced, while the price of crude oil has dropped 17 cents per barrel in the same period, Hope reports.

"In other words, just to offset the price deterioration and wage raises, the crude oil producer needs at least 25 cents more per barrel of oil just to get back where he was, price-wise, four years ago," he said. "This doesn't take into account increased costs for machinery, pipe and other materials."

While wages have risen 19 percent, oil well casing 8 percent, and oil field machinery and line pipe about 3 percent since 1957, the price of crude oil has been cut more than 4 percent.

If the independent crude oil producer is to remain active, he must receive some relief from the cost-allowable-price squeeze that has been eating into his pocketbook for the past four years. These have been the overriding factors contributing toward cutbacks in oil exploration, drilling and development during this period.

With an expected 2.7 percent increase in U.S. crude oil production, significant reductions in stocks during recent months, plus a good possibility there will be at least a slight decrease in imports, there is a good chance that the next few months will provide the relief valve crude oil producers sorely need—a supply-demand balance that will permit a reasonable increase in crude oil prices.

—The End

R. A. Semrad (left), manager of data processing for Sinclair Oil and Gas Company, Tulsa, explains magnetic tape to Mrs. Gerry Doolittle, geophysical computer in Sinclair's New Orleans division office, and Pat McKenna, Lease Department, Tulsa.

Sinclair pulls a switch in computer training

Company personnel will handle programing instead of outsiders not familiar with oil industry

In a radical switch from the usual approach of industry, Sinclair Oil and Gas Company has decided to teach computer operations to its company personnel instead of trying to teach oil company operations to computer experts brought in from the outside.

Furthermore, Sinclair personnel selected for computer training will continue to be oil men first and computer men second. They will continue their oil company vocations, but with the added knowledge necessary to use the computers as another tool in their work. Under this system, the force behind the electronic equipment will be the very people the "brains" were designed to assist—the working geologists, geophysicists, engineers, economists, landmen and personnel of other departments.

Other companies, both within and without the petroleum industry, generally have followed the pattern of setting up a new computer department consisting of electronic processing experts. The experts consulted with the functional departments to

determine and program work for the "brains."

Decentralized operation. No computer department, as such, will be organized by Sinclair when new high-speed computers are installed in Tulsa in 1962.

Mechanical operations will require some personnel, but the heart of the computer work—the programing—will be handled by the individual departments by department personnel, with supervision, when necessary, by a limited staff of computer people.

Advantages of new method. This system has numerous advantages over the centralized section of computer experts, Sinclair management believes.

No one can know better than oil department personnel what needs to be done and what they need to know for oil company operations.

With knowledge of the machines, they can determine what can be programed, and then prepare the setup themselves.

They also can constantly up-date programs for the equipment, which is an important factor in full utilization of the machines. For example, after a traffic program has been in operation for some time, the company could acquire new terminals, which would affect the entire picture of traffic control. Under the Sinclair system, this new information could immediately be programed into the machines by the traffic department itself.

Under the centralized computer division, there would likely be delays before the experts could come to the traffic department, gather the information, program it and put it into the "brains."

Probably the most important advantage of the Sinclair system, however, is the psychological effect on oil company personnel.

By becoming familiar with the equipment, realizing their capabilities and actually programing the work, employes lose their awe of the "brains." They discover that no "magic" is involved, as one Sinclair man expressed it.

With the enthusiasm and confidence that comes with such knowledge, the oil men will also be able to reach beyond the presently accepted programs and develop new problems for the equipment.

This already has occurred. One geologist who completed the first six-week computer school conducted at Sinclair is developing an idea for applying a medical diagnosis technique to the oil business.

The task would have been impossible without the electronic processing machines, but more important, the idea probably would never have been tried had not the geologist learned about the computers.

A computer expert wouldn't have the geological background to understand what is involved, nor would the geologist have known that such data could be handled by the equipment.

Six-weeks schools. In the six-weeks schools set up by Sinclair, computer personnel teach the oil men what the machines can do, how to program the data and how to look for work which is adaptable for the equipment.

Two classes of approximately 20 each, made of selected individuals from all departments and even district officers, have finished the training. At least one more class will be held in 1961.

A special two-weeks school for geologists and geophysicists follows the six-weeks course. By the time the equipment is installed, these people will have programs ready.

The Sinclair system was made possible by the type of equipment selected and new developments included in the machines. New computers will accept "plain, written English" and do its own translating into "computer talk."

A programer now merely needs to write a formula—"net pay equals gross pay less deductions," for instance—and feeds it into the machine. Previously, this formula would have required at least 10 digit coded numbers for the machine's use, and a computer expert was required to handle the chore.

Sinclair is also deriving a byproduct benefit from the computer school. With representatives from all departments brought together for an extended period, individuals from one section are learning about the problems and work of others. Better cooperation and appreciation are the results.

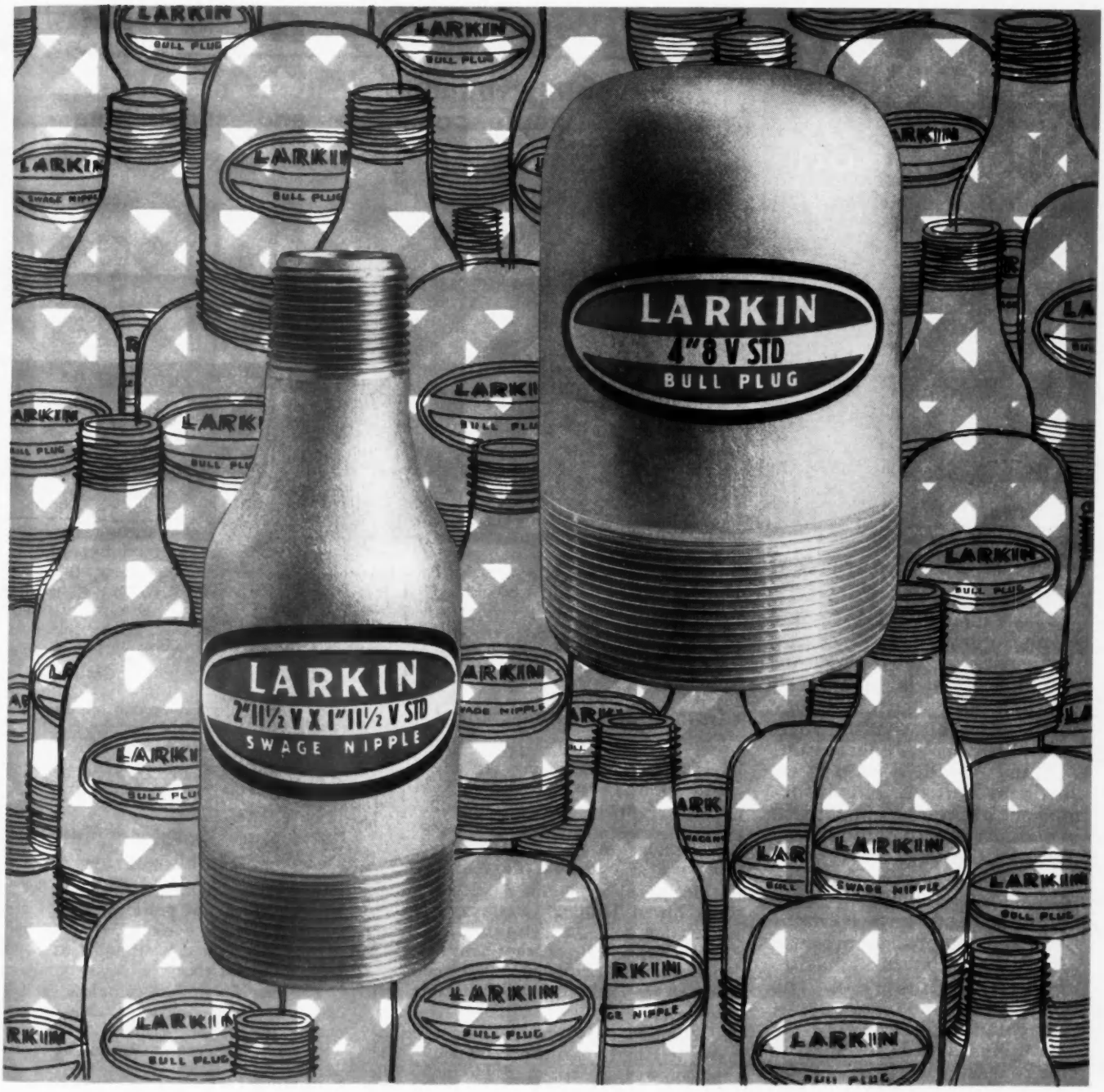
Based on Sinclair's experience, it all adds up to the conclusion that it is better to teach computer operations to oil company personnel. —**The End**

Build Your Personal Library With These Important Reprints

Pumping Manual	$1.00
Manual on Diesel-Electric Rigs	1.00
Drilling Notebook	1.00
Production Notebook	1.00
Continuous Seismic Profiler Aids Marine Exploration, Dr. C. B. Officer	50¢
Here's How to Pump a Triple Completion, D. N. Newby and J. A. St. John	50¢
Vast Marine Basins Being Explored in South America, C. A. Moore	50¢
Insoluble Residues Provide Good Regional Correlations, E. McCracken	50¢
Geologist's Interpretation of Drilling Mud Requirements, Dr. H. M. Johnson	50¢
How Major Geologic Features Developed in Kansas, J. M. Jewett	50¢
Speed Oil Property Present Worth Calculations, L. F. Ivanhoe	50¢
Water Can Be Controlled in Air and Gas Drilling, W. F. Hower et al.	50¢
Unique Program Combats External Tubing Corrosion in California, P. W. Hill and H. J. Kipps	50¢
New Drilling Technique Recovers 100 Percent Continuous Core, H. Henderson and J. F. Earl	50¢
How to Drill and Complete Wells on the Ocean Floor, D. Guinn	50¢
How to Determine the Contents of Horizontal Cylindrical Tanks, M. H. Green	50¢
Unique Magnetic Tape Playback System, H. H. Frost	50¢
Material Balance Equations for Gas Reservoirs with Water Drive, J. R. Frazer, A. E. Campbell	50¢
South Michigan's Oil Bonanza, G. F. Ells and R. E. Ives	50¢
Do You Think You Can Think?	50¢
Casing Failures, L. C. M. Darling	50¢
Are Milling Tools Being Used Properly? J. Chadderdon	50¢
The Calcium Chloride Gas Dehydrator, R. H. Ackerman	50¢
New DST Technique Yields Better Formation Samples, A. W. Smith	50¢
How Through-Tubing Bridge Plugs Work, R. W. Scott	50¢
Why Not Store Offshore Oil in Salt Domes? G. H. W. Schuster	50¢
Hydraulic Fracturing Pays Off, T. M. Garland and W. C. Elliott, Jr.	50¢
Reservoir Conditions Control Well Completion Practices, D. E. Fitzgerald	50¢
Optical Analog Computer Simplifies Gravity Analysis, R. W. Baltosser and S. W. Wilcox	50¢
Microbes Locate Gas Production in Test Field, Dr. R. J. Strawinski and W. B. Cox	50¢

Order from:

Reprint Department
GULF PUBLISHING COMPANY
P. O. Box 2608
Houston 1, Texas



LARKIN WAS FIRST

to put fittings in the quality class

The uniformity and quality that you find in Larkin Fittings today is the result of more than 25 years of continuous improvement and upgrading of these specialty products.

Quality made Larkin the leader, and you can buy . . . or sell . . . Larkin Fittings with full confidence that they are the finest fittings made.

LARKIN PACKER COMPANY

DIVISION KOEHRING COMPANY

WAXAHACHIE, TEXAS

LARKIN

...Through Your Supply Store

LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

NOW
MORE DRILLING INFORMATION

THE MODELS G7PW OR G7TW RECORDER

These models of the Geolograph Recorder were developed particularly for the contractors and operators desiring more detailed, recorded data concerning the four drilling variables—Rate of Penetration, Drilling Weight, Pump Pressure and Torque. This information is required to compete in today's highly competitive drilling situation.

Geologists obtain more information about rate of penetration and sub-surface formations and toolpushers are supplied with the information necessary to determine the optimum drilling rate for a particular formation.

Engineers and contractors can readily interpret the recordings of weight on bit, pump pressure (or torque), downtime, rate of penetration, tightspots and bit wear in making accurate decisions regarding existing drilling conditions.

The result: more hole per dollar.

When you drill your next well, specify the Model G7PW or G7TW Recorder. For additional information, ask for Catalog No. 220, or call your nearby Geolograph Oil Field Services office.

GEOLOGRAPH
OIL FIELD SERVICES
P. O. Box 1276
Oklahoma City 1, Okla.

Your industry at work

A monthly roundup of items of interest about people, companies and associations

The advisory committee for the Gulf Coast School of Drilling Practices opening at Lafayette, La., in April consists of (seated, left to right) Carl A. Kinney, committee chairman, Dr. G. G. Varvaro, school coordinator and W. C. Fatjo, committee member. Standing (left to right) are committee members Keith Lindley, Kirby Simmons, Harvey Fitzpatrick and W. A. Grapes.

Gulf Coast Drilling School Opens Spring Session April 3

The inaugural spring session of the new Gulf Coast School of Drilling Practices at Lafayette, La., will open April 3. The four-week school will be held in two half-sessions, from April 3 to April 14, and from May 1 to May 12.

Sponsored by the American Association of Oilwell Drilling Contractors in cooperation with the Petroleum Engineering Department of the University of Southwestern Louisiana at Lafayette, the school was held for the first time last fall.

With the assistance of AAODC headquarters in Dallas, the formation of the school was sparkplugged by the South Louisiana chapter of the AAODC in Lafayette, which last year was named the most outstanding among the 19 chapters throughout the country.

Scholarships provided by the companies sending men to the school are set at $200 per student for the full four-week session.

This school is unique in that it concentrates on drilling problems encountered in the coastal areas of Louisiana and Texas where drilling is extremely hazardous and costly because of the very high pressures It is designed for the men who actually supervise drilling operations at the well site, who have to make immediate decisions in critical situations that can directly affect the success or failure of drilling operations, according to Carl A. Kinney, drilling superintendent for The Atlantic Refining Company at Lafayette and chairman of the school's advisory committee.

Companies desiring further information and applications can contact Dr. G. G. Varvaro, professor and head of the university's Petroleum Engineering Department, or Chairman Kinney at Box 635, University Station, La.

Petroleum Operations, Inc., Organized in New Orleans

Petroleum Operations, Inc., headed by James R. Crow as president, and Pierre Gautreaux as vice president, recently opened offices in the Oil and Gas Building in New Orleans.

The new firm offers complete geological and engineering services with emphasis placed on drilling, completing wells, plus operating producing properties.

Oil Recovery Corporation Opens West Texas Office

Oil Recovery Corporation has opened a new district office at Midland, Texas. The office, located in the Wilkinson-Foster Building, has been established to serve its Orco Process Licenses in the Permian Basin area of West Texas and New Mexico.

Sunray Transfers Canadian Property to Pacific Petroleum

All the Canadian properties of Sunray Oil Company of Tulsa were transferred to Pacific Petroleums Ltd., at a meeting of company representatives held recently. The acquisition of Sunray's Canadian holdings was approved by Pacific shareholders at a general meeting on December 20.

The Sunray company, active in the

Packers. Where retrieving is not required, other models are available for milling out and pushing to bottom *any* bridge plug or cement retainer, as well as the packers and plugs previously mentioned... one or two at a time, if required.

With the Baker Packer Milling Tool you save a great deal more than just time. For experience has shown (see case histories at right, for example) that lightweight workover rigs generally can be used satisfactorily. The use of tubing instead of drill pipe and collars often adds further savings. And report after report states that the job was accomplished without circulation, using only a minimum amount of fluid, spotted as needed.

But speed and savings are not the entire story. It may be of great importance to successfully retrieve the packer or plug from the well. Such is the case where it is necessary to remove the upper packer in a multiple completion without damaging the lower packers. Or where the packer or plug is set above a smaller O.D. liner.

Drawing on their long experience in designing ways to latch into and hold onto packers, Baker built the dependable catch sleeve (with safety release) which is used to hold the packer body for retrieving. Again, field experience has proven this feature to be both practical and reliable.

To benefit most from the high degree of drillability that is built into Baker Retainer Production Packers, Bridge Plugs and Cement Retainers... ask your Baker man to provide you with milling tool service. He is well-prepared to help you with your special problems.

BAKER
OIL TOOLS, INC.
HOUSTON,
LOS ANGELES,
NEW YORK

BAKER

A BAKER JUNK BASKET

installed immediately above a Baker Packer Milling Tool will remove most of the metal cuttings ... enabling the milling tool to do a more efficient job.

Reminder:

Removing cement sheath, perforation burrs and other obstructions will reduce the number of prematurely set and leaking packers and plugs... reduce the need for milling jobs. Clean your casing with a

BAKER ROTO-VERT CASING SCRAPER

LOOK AT THESE RESULTS

Kansas

MILLED OVER AND RETRIEVED BAKER RETAINER PRODUCTION PACKER

MILLING TIME: 45 MINUTES

Packer Size 5½", 5,000 ft. No circulation, let 50 bbls oil gravitate down casing.

Oklahoma

MILLED OVER AND RETRIEVED BAKER RETAINER PRODUCTION PACKER

MILLING TIME: 1 HOUR, 15 MINUTES

Packer Size 7", 19,435 ft. Circulation: 3½ bbls/min.

New Mexico

MILLED OVER AND RETRIEVED RETAINER-TYPE PACKER

MILLING TIME: 2 HOURS, 30 MINUTES

5½" Brand "X" Packer, 7500 ft. Fluid 2500 ft. down. Junk Basket really paid off.

Wyoming

MILLED OVER AND PUSHED TO BOTTOM BAKER MAG. BRIDGE PLUG

MILLING TIME: 35 MINUTES

Bridge Plug Size 5½", 6,700 ft. Used pulling unit, rotating head and pump.

Texas

MILLED OVER AND RETRIEVED BAKER RETAINER PRODUCTION PACKER

MILLING TIME: 1 HOUR, 15 MINUTES

Packer Size 5½", 7,000 ft. Used 5,000 lbs. set-down weight. 60 rpm Used Junk Basket.

Louisiana

MILLED OVER AND RETRIEVED BAKER RETAINER PRODUCTION PACKER

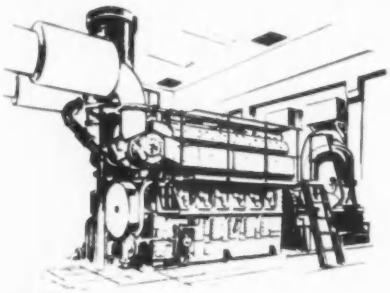
MILLING TIME: 2 HOURS

Packer Size 7", 6400 ft. 1½ hours to retrieve.

PAXMAN Diesels for Exploration and Production

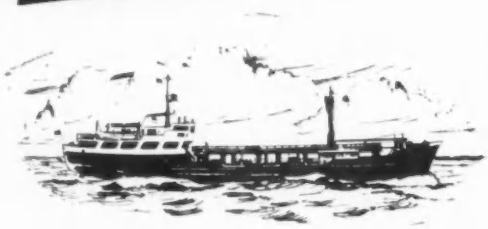
Vee-form diesel engines for drilling rigs and associated power requirements. Air-cooled units 100 to 610 b.h.p. Water-cooled units 130 to 1100 b.h.p.

PAXMAN Diesels for Pumping and Generating



Medium and high speed engines for pipeline pumping stations and refinery power stations. Powers from 130 to 2270 b.h.p.

PAXMAN Diesels for Transportation



Medium and high speed engines for marine service and terminal installations. Powers from 130 to 2270 b.h.p.

PAXMAN all along the pipe-line!

Throughout the world's oilfields, Paxman diesels are giving dependable service—with low running costs and easy maintenance. Wherever they operate, they are backed by PAXMAN SERVICE which means men and spares wherever you want them—and fast!

DAVEY, PAXMAN & CO. LTD., COLCHESTER, ENGLAND *a member of the* RUSTON *Group.*

Your industry at work

Canadian petroleum industry for many years, held interest in approximately 3,000,000 acres in the oil and gas-producing areas of British Columbia and Alberta. At present, 94 gas wells and 15 oil wells are located on these properties. Most of the Sunray acreage is situated in northeastern British Columbia, where it is interspersed with Pacific holdings. The combined Pacific-Sunray properties form large blocks in the Peace River area, which now supplies gas to the Westcoast Transmission system and which will be the principal source of supply for a proposed new oil pipe line to connect these fields with the Vancouver market. Farther north, near Fort Nelson, B. C., the Sunray holdings augment Pacific's land in an area where some of Canada's major natural gas discoveries have recently been made.

Pacific Petroleums will issue 861,310 shares of common stock in exchange for the Sunray properties. With these and other recent acquisitions, Pacific becomes the major holder of potential oil and gas land in British Columbia and ranks as one of Canada's leading producers of oil and natural gas.

Argentina-Cities Service Acquires White Eagle Interest

Acquisition by Argentina-Cities Service Production Corporation, a wholly owned subsidiary of Cities Service Company, of a 50 percent interest in the Argentine operations of White Eagle International, Inc., has been announced.

The present operation in the Argentine includes the waterflooding of certain oil properties and an exploration program in anticipation of further joint operations and activities. White Eagle will continue as operator of the projects now in progress and Argentina-Cities Service will provide technical assistance.

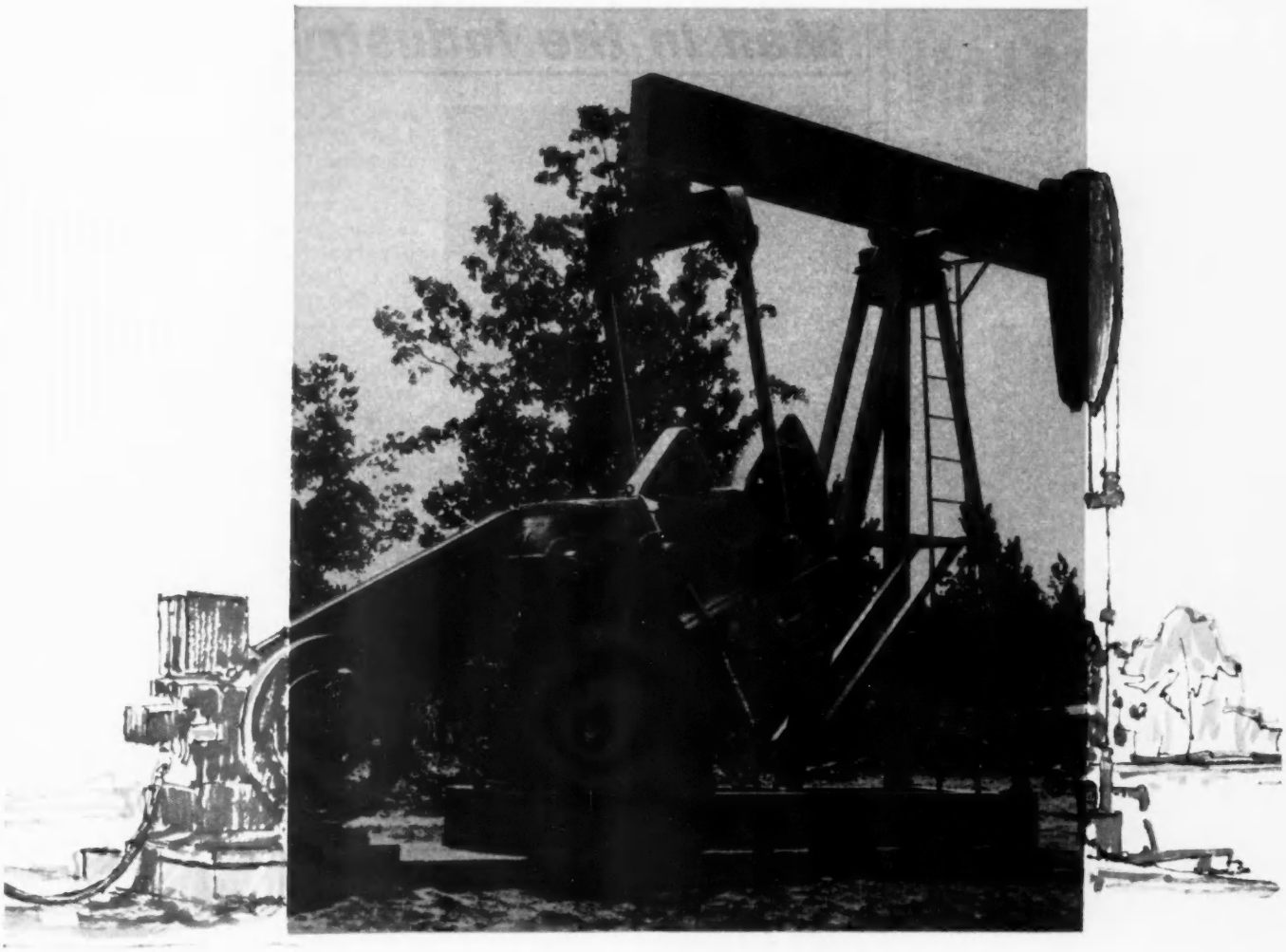
Reese H. Tucker, vice president of Cities Service Company, and Olin R. Prather, president of White Eagle International, Inc., will serve as a management committee directing the joint venture.

Richfield Oil Inaugurates Aid to Education Program

Inauguration of a $110,000 yearly Aid to Education Program to assist western colleges and universities has been announced by Richfield Oil Corporation.

The new program, which emphasizes unrestricted grants that entitle school administrators to spend the money as they see fit, supplants a more limited program of fellowships and special grants offered by the company in previous years.

Slightly more than half the total, $60,000, will go to private colleges and universities in the form of unrestricted grants. An $18,000 program offering nine fellowships in seven schools, three of which are state universities, will be continued. The balance of the $110,000 will be contributed in the form of capital funds, research funds and indirect aid to education.



See anything unusual here?

Well—look closely! It's an "Oilwell" Century Pumping Unit, a Witte Gas-Gasoline Engine, a quality Polished Rod (as well as a bottom hole pump and sucker rods that you can't see). And what's more—it was all obtained from the nearby "Oilwell" store.

So, stop looking for something unusual in this familiar scene.

This is typical of the many 100% "Oilwell"-equipped wells where expertly engineered and precision built machinery is providing reliable service with a minimum of attention and expense.

Your "Oilwell" store has all this and more too—a capable and courteous crew willing to assist you in the selection of the proper equipment for any of your production needs.

USS and "Oilwell" are registered trademarks

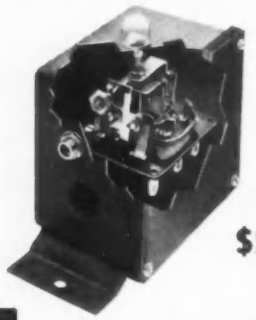
This mark tells you a product is made of modern, dependable Steel.

USS Oil Well Supply Division of United States Steel

Executive Offices: Dallas, Texas

Export Offices: 30 Rockefeller Plaza, New York 20, N. Y.

VIBRATION and SHOCK SWITCH!



VS-1
$29.50

Explosion Proof add $23.50.

MURPHY

Sensitive to abnormal oscillation in two planes of motion, recommended for use on engines, pumps, pumping units, compressors or any other equipment subject to destructive motion.

Same model can be wired to ground ignition, sound alarm, activate control panel lights, or operate valves such as Diesel fuel shut-off valves, and electric motor controller circuits. Rated at 5 Amps, 110 V AC.

•

Also safety switch-gauges to protect engines and equipment against any type of malfunction.

Time, temperature, pressure, level controls, automatic engine or motor controllers and complete control panels.

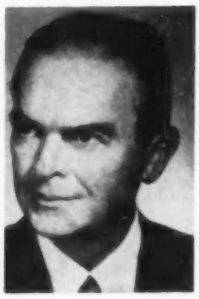
At your engine dealers or write:

FRANK W. MURPHY MANUFACTURER, INC.
P.O. BOX 4007
RANCH ACRES STATION
TULSA, OKLAHOMA

MURPHY SAFETY SWITCH OF CALIFORNIA
11812 Davenport Road • Los Alamitos, Calif.

Men in the industry

H. W. Haight



Nelson Jones

H. W. Haight, who has been serving as a **Humble Oil & Refining Company** vice president and director with broad responsibilities for exploration and production, has been named an executive vice president. **Nelson Jones,** who has been general counsel, was elected a member of the board of directors. **Forrest M. Darrough,** associate general counsel, was appointed general counsel to succeed Jones.

Joel H. Hirsch, formerly chief development engineer at **Gulf Research & Development Company,** has been appointed director of the Laboratory's newly formed Development Engineering Division.

Arthur S. Dickinson, district geologist for **Lion Oil Company, Division of Monsanto Chemical Company,** has been named an exploration geologist under Lion's new advancement plan for rewarding and making effective use of geologists and geophysicists who find oil for the company.

Stanford J. Hetzel has been appointed market analyst and **Raymond F. Winch** was appointed project analyst in the recently organized Commercial Development Division of **Sun Oil Company's** Research and Engineering Department.

B. F. Stradley has been elected to the new office of financial vice president of **Phillips Petroleum Company.** He is a director of the company and a member of the executive committee. Also, **W. F. Martin** was elected treasurer and **R. N. Sears** elected secretary. Both will report to the financial vice president.

John F. Redmond has accepted a position as vice president in charge of exploration and production with **Shell Oil Company of Canada, Ltd.** Redmond was manager of the head office Exploration and Production Economics Department for **Shell Oil Company. E. G. Christianson** succeeds Redmond.

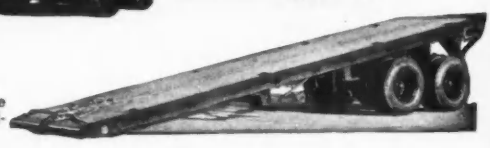
OILFIELD TRANSPORTATION EQUIPMENT

OILFIELD TRUCK AND FLOAT

Thornycroft Sandmaster 252" wheel base Oilfield Truck. Hands-England full Oilfield Body. 60,000 lb. winch, heavy duty gin poles, winch operated gin pole risers and folding SAE king pin.
Hands-England 75,000 lb. capacity, tandem axle Oilfield Float 30' 0" long and 9' 6" wide, folding support legs and inverted 36" fifth wheel.
Truck and Float on Michelin 18.00 x 25. Sahara "X" sand tires.

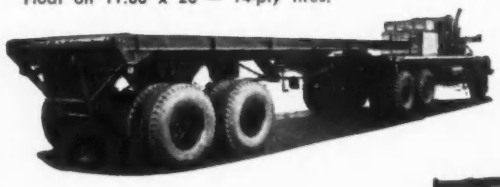
OILFIELD FLOAT

Hands-England 75,000 lb. capacity tandem axle Oilfield Float 30' 0" long and 8' 6" wide, folding support legs and inverted 36" fifth wheel.
Float on 11.00 x 20 — 14-ply tires.



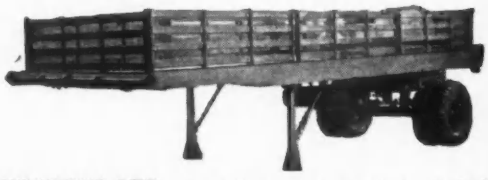
OILFIELD TRUCK AND FLOAT

Scammel Constructor 261" wheel base Oilfield Truck.
Hands-England 75,000 lb. capacity tandem axle Oilfield Float 30' 0" long and 9' 6" wide folding support legs and inverted 36" fifth wheel.
Truck and Float on 14.00 x 20 — 18-ply tires.



OILFIELD FLOAT

Hands-England 25,000 lb. capacity single axle Oilfield Float 24' 0" long and 8' 0" wide, folding support legs and SAE king pin 11.00 x 20 — 12-ply tires. Steel stake sides.



HANDS-ENGLAND OILFIELD EQUIPMENT LTD. Works Road, Letchworth, Herts., England
Telephone: Letchworth 600 Telegrams: Oil, Letchworth. Cables: Oil, Letchworth, England
BMJ

New Drilling Detergent Saves Drilling Dollars

D-D®, Magcobar's new drilling detergent, is recommended only for operators and contractors who like money. Because, when you use D-D on your well, it's hard **not** to save money.

Look what D-D does. By reducing surface tension in water base muds, it speeds up the rate of penetration. What's more, it settles out sand, extends the use of low pH muds to greater depths, and reduces costs of chemical treatment.

The really big surprise about D-D is that so little does so much. Initial treatment is only ten gallons per 500 barrels of drilling fluid. Maintenance is two to six gallons per tour.

Like money? You can learn all about D-D by writing for the new brochure. Magnet Cove Barium Corp., P. O. Box 6504, Houston, Texas.

Another **Well Done** with Magcobar Technology

®Registered trademark, Magnet Cove Barium Corporation.

Magcobar
Complete
DRILLING MUD SERVICE

DRESSER INDUSTRIES, INC.
OIL • GAS
CHEMICAL
ELECTRONIC
INDUSTRIAL

CUT STUCK SAND LINES INSIDE TUBING

KINLEY SAND LINE CUTTER

J. C. KINLEY CO., Licensees

ABILENE, TEXAS
Eads Engineering Services, Inc.....OR 2-8655
Dunnam Service & Equipment Co.....OR 2-5331
BAY CITY, TEXAS—J. P. Graham.....CI 5-4526
CASPER, WYOMING—C. A. White.....3-5264
FULLERTON, CALIFORNIA—Dyna-Log...LA 6-1184
GLENDIVE, MONTANA—C. A. White....EM 5-3833
HOBBS, NEW MEXICO
Horne Well Service Co.....3-5396
KILGORE, TEXAS
Davis-Kemp Tool Co., Inc.....5541
LIBERAL, KANSAS—Rainbo Service...Main 4-3598
LINDSAY, OKLAHOMA
Rainbo Service Co.....PL 6-2530
MIDLAND, TEXAS
Luccous Service & Eqpt. Co.....MU 2-8311
NATCHEZ, MISSISSIPPI
Davis-Kemp Tool Co., Inc.....2-3021
NEW IBERIA, LOUISIANA
Klein-Deco Wire Line Service.....EM 9-6632
OKLAHOMA CITY, OKLAHOMA
Rainbo Service Co.....ME 4-2131, ME 4-0105
STERLING, COLORADO
Cable Drilling, Temp. & Well Serv. Co...LA 2-4761
VIDALIA, LOUISIANA
Davis-Kemp Tool Co., Inc.....ED 6-4224
WHITTIER, CALIFORNIA
Kline Wire Line Co.....OX 3-2731
WICHITA FALLS, TEXAS
Eads Engineering Services, Inc.....766-0931
WILLISTON, N. DAKOTA
C. A. White.....GR 3-6555

Men in the industry

Ralph Walsh has been elected president and a member of the board of directors of the **Macmillian Petroleum Corporation.**

Walter Gardner, formerly of **Arkansas Fuel Oil Corporation** at Lafayette, La., has transferred to **Cities Service Oil Company** in the Marine Division at Houston.

Maris G. Fletcher has been named director of publications at **British-American Oil Producing Company.** Fletcher succeeds **Andy Tarvin.**

Karl A. Riggs, consulting engineer, has recently returned from a consulting assignment in Australia. The itinerary included a flight around the world with short visits to Egypt, Germany, Greece, India, Italy, Switzerland and Thailand.

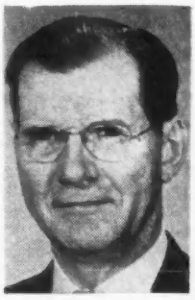
D. H. Elliott, consulting photogeologist, has moved his offices from Casper, Wyo., to Tucson, Ariz.

R. (Cotton) Makin is now in Formosa, as consultant for **Chinese Petroleum Corporation** in their operations there.

Byron L. Keil has been elected a vice president of **Wilson Exploration Company** and **Hugh B. Downing** was elected to the position of secretary-treasurer.

Charlie Shipp has been appointed contracts manager for the **Cascade Drilling Company, Limited.** Shipp had been manager of the Ryland Drilling Company Limited.

Charlie Shipp



L. W. Gardner

Louis W. Gardner has been appointed director of the Geophysical Research Division, **Gulf Research & Development Company,** a subsidiary of **Gulf Oil Corporation.**

John W. Young, formerly chief landman in the Midland district for **Cities Service Petroleum Company,** has been promoted to assistant landman for the Southwestern region. He succeeds **Sam Franklin** who was promoted to head landman for the Mid-Continent region in Bartlesville, Okla. **Clyde Parker** was named exploration manager in the Midland district. **Mac E. Fitts,** formerly district geophysicist, has been promoted to regional geophysicist. He succeeds **E. L. Current,** recently transferred to the New York headquarters staff, and **Ben E. Willis** is the new district geophysicist. He transferred from San Antonio where he was on the district exploration staff of **Arkansas Fuel Oil Company,** which recently was merged with Cities Service Petroleum.

Donald Forrest Clements has joined the staff of the Mechanical Division of **Esso Research and Engineering Company,** the major scientific and engineering affiliate of **Standard Oil Company (New Jersey).**

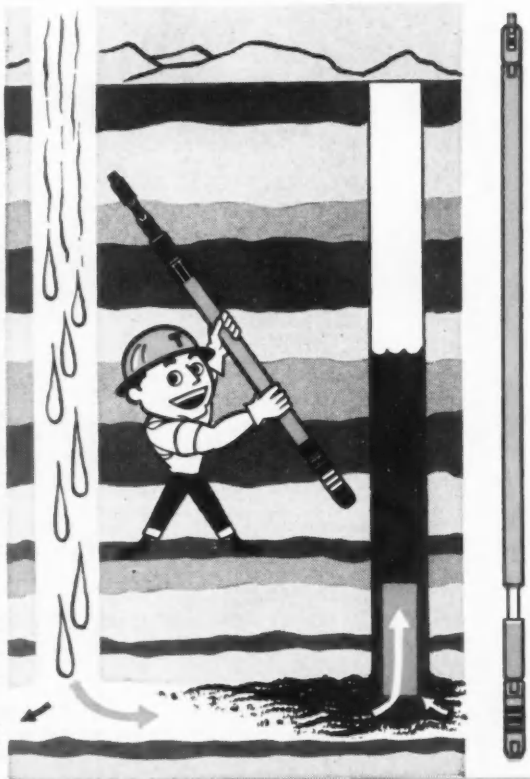
Frank Whittington, vice president of **Bentsen-Whittington Oil Company,** McAllen, Texas, has been named ninth prize winner in the business division of the Third Annual Minox Contest.

Gene L. Shaw has been named regional geologist for the Rocky Mountain Region of **Lion Oil Company, a division of Monsanto Chemical Company,** and **Leslie L. Greenfield** has been named district geologist in the Southern region.

Oran A. Graybeal has been appointed administrative assistant to **R. E. Foss,** senior vice president directing production, **Sunray Mid-Continent Oil Company,** and **Gordon E. Millhouse** has been named manager of engineering for production.

Walter Henry Nelson, former editor of the American Petroleum Institute *Quarterly,* has been named vice president of **Herbert M. Kraus & Company,** Chicago-based public relations firm.

THOMPSON PUMPS GIVE YOU DEPENDABLE LOWER LIFTING COSTS



FOR PRIMARY AND SECONDARY RECOVERY

Oversize Pumps: 1⅛" Bore for 2" Tubing, 2⅛" for 2½" Tubing, 2½" for 3" Tubing.

Thompson PUMP COMPANY

DRAWER 591 OKMULGEE, OKLAHOMA

BIG FOOTAGE IN ALL FORMATIONS

The only true measure of a Rock Bit is its ability to make hole! . . . These factors are *musts* for high penetration performance:

OUTSTANDING METALLURGY that insures long wear of cones and journals . . . maximum resistance to chipping and breakage of bearings under shock loads.

DYNAMIC DESIGN that insures effective tooth-to-tooth and tooth-to-groove clearances . . . maximum bearing areas to withstand heaviest bit loading.

QUALITY + MANUFACTURING that sets and maintains precision standards worthy of these experience-tempered, field-proved designs.

The "CP" of Chicago Pneumatic is recognized as the symbol of "Cost-cutting Performance" by top drilling contractors. 41 conveniently located Warehouses insure 'round-the-clock delivery.

Chicago Pneumatic

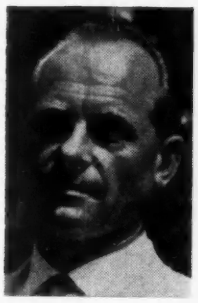
FT. WORTH, TEXAS

BITS • DRILL COLLARS
REAMERS • TOOL JOINTS

Men in the industry

John C. Johnston, vice president and division manager, **Pan American Petroleum Corp.,** has been elected a member of the advisory committee at the **Bank of the Southwest,** Houston. Also, **Landon H. Goodman** was promoted to vice president and **Ralph Daniel** was promoted to assistant vice president.

Dr. Wolf Maync has resigned his position with the Compagnie d'Exploration Petroliere, Chambourcy and Paris, France, as research geologist, supervisor of the geological laboratory and consultant. After 25 years of activities in foreign countries with different oil companies, he will open an office of his own in Berne, Switzerland, to engage then entirely in consulting work (micropaleontology, stratigraphy).



Dr. Wolf Maync

D. W. Mathews has been appointed superintendent of **Continental Oil Company's** Oklahoma Production Division. Mathews will succeed **C. R. Wallen** who has transferred to Great Bend, Kan., as production division superintendent.

Sam H. Field has been appointed assistant manager of the Legislative Department of **Socony Mobil Oil Company, Inc.,** Field will report to **R. C. Hinman,** manager of the Department.

J. C. Heggblom who has been general manager of **Gulf Oil Company of Libya,** has transferred to Nigeria to act as general manager of **Nigerian Gulf Oil Company. N. C. Simpson,** formerly vice president of **Gulf Oil Corporation,** Pittsburgh, succeeds Heggblom in Libya.

Aaron H. Griffin has been appointed manager of **Texas Gas Transmission Corporation's** Louisiana Division. Griffin succeeds **W. O. Davis** who transferred from the Lake Charles office to Memphis, Tenn.

S. E. White, general superintendent, Dallas, has been appointed assistant division manager of the Dallas Division for **Texaco Inc.** Also, **J. H. Moore,** division petroleum engineer, has been advanced to general superintendent replacing White, and **E. F. Egan,** assistant division petroleum engineer, has been advanced to division petroleum engineer, succeeding Moore.

Paul L. Kelly, division exploration manager, Bismarck, N. D., has left **Calvert Petroleum Company,** Tulsa, to enter the industry as a geologic consultant and independent oil operator. Kelly will open offices in the Professional Building in Bismarck.

AUTHORIZED MANUFACTURERS OF NO-WALL-STICK DRILL COLLARS

ENGINEERING ENTERPRISES, INCORPORATED

1200 San Jacinto Bldg.
Houston 2, Texas
CA 8-0386

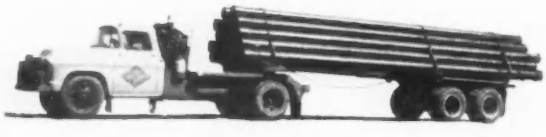
Congrats and $25 for this quip to DEAN H. CROWELL, 5919 Vickery Boulevard, Dallas, Texas

"heard we had a duster"

Joe Roughneck's seen dusters in his day, but he's brought in many a producing well, too. And throughout the years, Joe's been the one to specify Lone Star API pipe. He knows it's tough, dependable and available conveniently in the heart of the oil country.

Made by the oil country's own steel mill, Lone Star casing, tubing and line pipe is known for quality. Our ultra-modern plant maintains rigid quality control from ore to finished product.

Neighbor, wherever you are, specify Lone Star and we both get a good deal.



© 1956 Lone Star Steel Company

Lone Star STEEL COMPANY

EXECUTIVE—SALES OFFICES
W. Mockingbird Lane at Roper • P. O. Box 12226 • Dallas, Texas
DISTRICT SALES OFFICES
912 Republic National Bank Building, Dallas, Texas
Houston, Texas | Midland, Texas | Tulsa, Oklahoma

Men in the industry

Paul N. Temple has been elected president of **Esso Iberia, Inc.,** Spanish exploration affiliate of **Standard Oil Company (New Jersey).** Temple was also elected president of **Esso Standard Espanola, S.A.,** Jersey's marketing affiliate in Spain. Temple will make his headquarters in Spain.

P. N. Temple

John M. Cooper, a former **Gulf Oil Corporation** employe who recently retired as assistant managing director of **Kuwait Oil Company, Ltd.,** owned jointly by Gulf and the **British Petroleum Company, Ltd.,** has been awarded the insignia of "Honorary Commander of the Most Excellent Order of the British Empire." The award was made by the Minister of Power on behalf of the Queen of England in recognition of his valuable service to British official interests.

John W. Timmins of Dallas, special counsel on foreign operations to **Sun Oil Company's** Production Department since 1956, retired recently after 41 years of service as a Sun attorney.

Rayce A. Coffin has been appointed by **Helmerich & Payne, Inc.,** to the position of treasurer.

Roger Whitney Stoneburner has been named manager of exploration of **Southern Natural Gas Company.** He will conduct activities from the Houston office.

Clyde A. Wheeler, former staff assistant to former President Eisenhower, has joined **Sunray Mid-Continent Oil Company** in Tulsa as public affairs representative.

Charles W. Hickok, formerly project engineer at Dewy, Okla., for **Oil Recovery Corp.,** has been named assistant manager of production. At the same time, **H. J. Ramsay, Jr.,** formerly evaluation engineer, was named assistant manager of engineering; **L. A. Hampton,** formerly CO_2 plant engineer, has been named chief mechanical engineer, and **W. D. Granberry,** formerly petroleum engineer at Dewy, is now evaluation engineer at the division office, Tulsa.

Walter Ruska has opened offices as a consultant in research instrumentation, particularly in the fields of mechanics, optics, geomagnetics and high pressure technology. The new offices are located in Houston.

Thomas P. Simpson, general manager of engineering and operations analyst for **Socony Mobil Oil Company, Inc.,** has retired after 35 years of service.

BURNS CASING HANGER

for easier circulation around the hanger and a positive seal after cementing

Burns Casing Hangers embody all the advanced features of the Burns line—one-piece streamlined body with the slips contained in separate machined recesses in the body. The entire area of each slip is completely supported by the strength of the hanger itself throughout the full length of the slip travel. This eliminates broken slips and allows positive grip action.

Each slip acts independently of the other in Burns Casing Hangers, so that the load is evenly distributed by the entire area of all the slips. Positive action is assured by the provision of three springs to raise each slip. Slips are free to release as the load is removed and will act as a reliable casing catcher when retrieving the liner. Circulating grooves can be milled in the body between the slips for cementing. Circulating grooves reduce the velocity around the hanger assuring a better cement job. Cementing the well can be done either before or after the hanger is released.

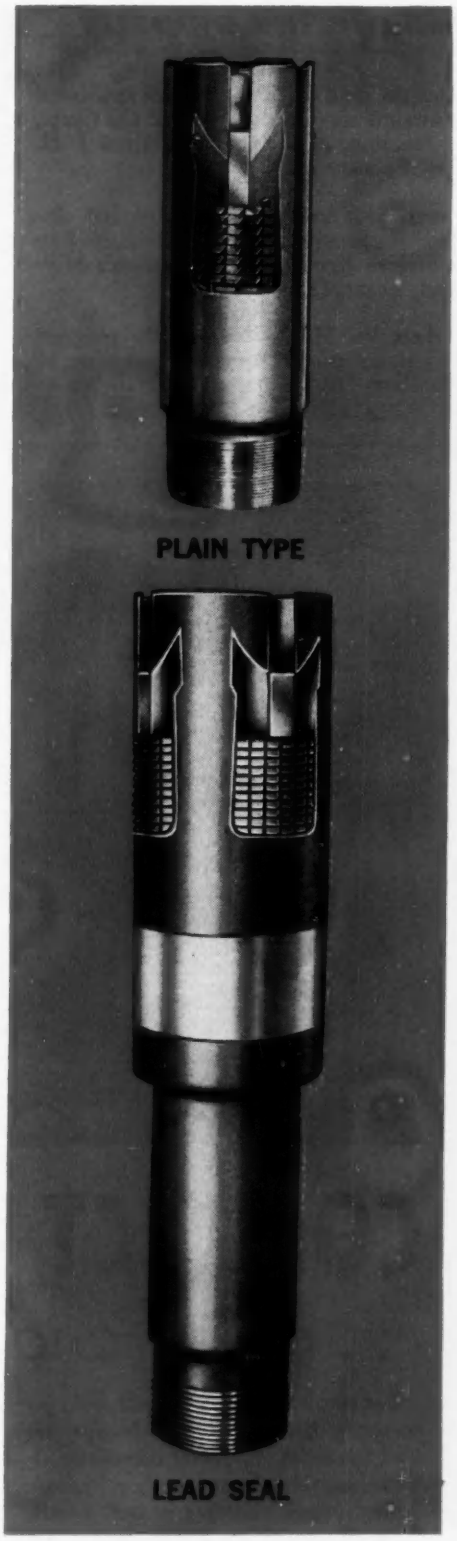
Burns Casing Hangers can be set properly even though the oil string is frozen by rotating the running in string six turns to the right which allows the slips to raise against the water string and by taking a stretch on the frozen oil string. Hanger is set and casing suspended properly. Burns casing hangers do not depend on drag spring friction action to set the slips.

BURNS PLAIN TYPE CASING HANGER

Simplified, streamlined, one-piece body... used where support is needed for the oil string and where pressure seal is not required.

BURNS LEAD SEAL CASING HANGER

Only hanger manufactured with sealing element located below the slips. No danger of broken lead jamming the slips when retrieving the oil string.



Write today for complete product catalog

BURNS TOOL COMPANY

Sold through leading supply houses

8346 Salt Lake Avenue, Bell, California LUdlow 2-6209

Branch office:
217 Walker Road
Farmington, New Mexico

Field service points:
Bakersfield, Taft, Coalinga,
Ventura, Santa Maria, Casper

Men in the industry

Richard W. White has been appointed insurance coordinator for **Gulf Oil Corp.**, at Houston, succeeding the retired **J. H. Van Eman.**

Darrell E. Smith has been named district exploration superintendent of **Pan American Petroleum Corporation's** Midland, Texas, District.

Robert W. Miller has recently resigned as a member of the board of directors of **Standard Oil Company of California.**

Edward L. Steiniger, president and director of **Sinclair Oil Corporation,** has been elected to the board of trustees of **Emigrant Industrial Savings Bank,** New York. Steiniger also holds directorships in the **Richfield Oil Corporation, American Petroleum Institute** and the **National Industrial Conference Board.**

E. L. Steiniger

J. Howard Marshall has resigned as executive vice president of Signal Oil and Gas Company to become president of **Union Texas Natural Gas Corporation.**

Ray A. Burke, manager of the West Texas Division, for **Union Oil Company of California,** has become director of exploration. Also, **Arch Dawson,** formerly manager of the Oklahoma Division, has become director of production, and **C. F. Bowden** has been named the new manager of the new Central Division. **W. Layton Stanton,** manager of the Rocky Mountain Division, has been transferred to Union's home office.

A. J. Organ has been appointed vice president and general manager of **Llano Colombia Corporation** in Bogota, Colombia. Llano Colombia is a wholly owned subsidiary of **Llano Drilling Company** of Midland, Texas.

W. H. Morris

C. J. Allen

William H. Morris, president of **Sinclair Oil & Gas Corporation** since 1957, and **C. J. Allen,** recently elected president of **Sinclair Refining Company,** have been elected to the board of directors of **Sinclair Oil Corporation.**

J. A. McQuilkin, a director of **Standard-Vacuum Oil Company** since 1952, has been named a vice president and a member of the executive committee. At the same time, it was announced that **J. W. McCobb,** a vice president and director of Stanvac, was joining **Standard Oil Company (New Jersey)** as regional coordinator for the Asian-African-Australasian areas where Stanvac operates.

Robert L. Kidd has been elected chairman of the board and **J. Edgar Heston** as president of **Cities Service Oil Co. (Delaware).** Kidd, president of the company since 1956, will continue as its chief executive officer. Heston, who has served as president of Arkansas Fuel Oil Corp., since 1956, will continue in that position, but will move his offices from Shreveport, La., to Bartlesville, Okla.

Eugene W. Kane has been appointed supervisor of the Projects Analysis Division in the Crude Oil Planning Department of **Standard Oil Company (Indiana).**

J. A. Champion has been named area geologist for **Shell Oil Company's** Houston area.

CORRECT BALANCE

. . . easily and exactly!

For peak efficiency a well must be correctly balanced. The deeper the well the more important correct counterbalance becomes.

Even small changes in well conditions can result in power waste and unnecessary wear and damage if a pumping well is not properly balanced.

Correcting the adjustment on this JENSEN Rotary Balanced JACK is such a simple one-man job there is no excuse for any well to ever be improperly balanced—whether deep or shallow.

Get the money-saving facts on JENSEN JACKS before you equip that next well.

STOCKED BY YOUR LOCAL SUPPLY STORE

Made by JENSEN BROS. MFG. CO., INC., P. O. Box 477-D, Coffeyville, Kansas
Export Office: 250 Park Avenue, New York 17, N. Y.

JENSEN JACKS

DRILLING PRODUCTION PACKERS?

THE A-Z PACKER BIT DOES THE JOB FAST!

With Tubing as Drilling String—

Drills packers in 3 to 4 hours

Drills bridge plugs in 1 hour

Cement at 20 feet per hour

With Drill Pipe as Drilling String—

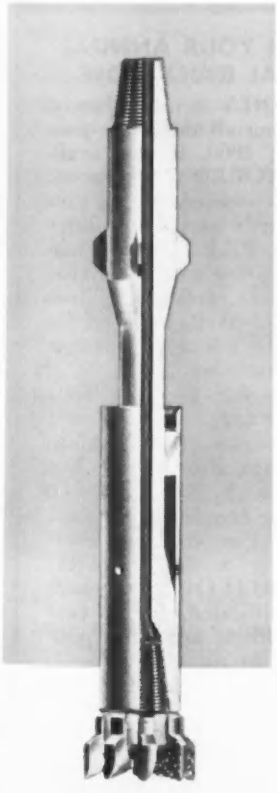
Packers in 1 to 2 hours

Retainers in minutes

Cement faster than rock bits

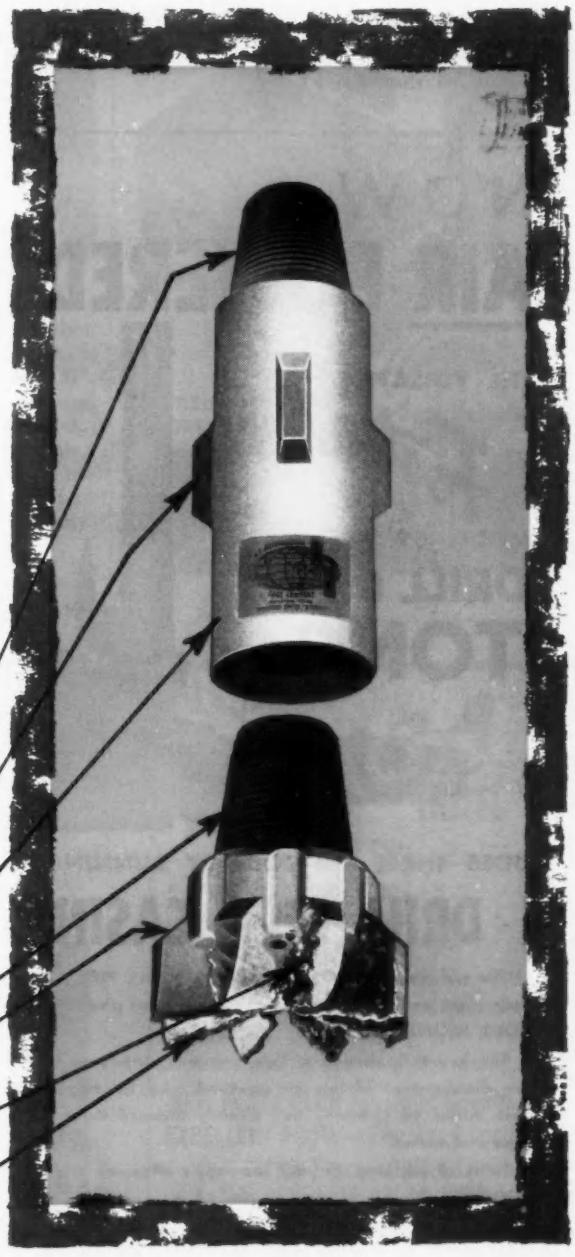
If you wish to save rig time and not lose cones in the hole, use the A-Z Packer Bit designed especially for this type of job.

If down hole conditions necessitate retrieving the packer, ask for the A-Z Packer Retriever. On all other types of milling jobs, call A-Z for experienced service men using the "World's Fastest Milling Tools."



A-Z PACKER BIT
WITH A-Z PROTECTIVE BASKET

Write for catalog listing the most complete line of milling tools available.


Standard rock bit connection.
Hardfaced protective pads.
Heat treated alloy steel head and body.
Standard rock bit connection.
Stabilized mill blade ground concentric to body.
Cutting surfaces dressed with ZITCO—A-Z's fragmented tungsten carbide material.
Dressed for bottom cutting only—can't damage casing.

WORLD'S FASTEST MILLING TOOLS

A-Z INTERNATIONAL TOOL COMPANY

5619 Fannin Street Telephone JA 6-4794 Houston 4, Texas

Branches: Lafayette, Houma, Harvey, La.
Victoria, Texas

INTERNATIONAL TOOL & SUPPLY CO.

45 Rockefeller Plaza • New York 20, N. Y.

A-Z EXPORT, S. A.

Maracaibo, Anaco, Las Morochas, Venezuela
Bogotá, Colombia

Men in the industry

William J. Rogers has been promoted to chief petroleum engineer in the general office of the Production Department of **Sinclair Oil & Gas Company** in Tulsa. Rogers succeeds **Lloyd Holsapple,** recently named manager of the Unitization and Part Interest Department.

M. E. Michael has been named district superintendent of **Phillips Petroleum Company's** Western Kansas district, headquarters in Great Bend, Kan. Also, **A. J. Willis** was assigned to the Morgan City, La., district headquarters as superintendent of that district.

John Getgood has been appointed president of **Pacific Petroleums Ltd.,** in Calgary, Alta. Getgood succeeds **George L. McMahon** who has been appointed vice chairman of the board. Prior to assuming the presidency of Pacific Petroleums, Getgood was vice president of Phillips Petroleum International Corporation in New York.

John Getgood

Benjamin F. Baldwin has been named division geologist for **Pan American Petroleum Corporation's** North Texas-New Mexico Division. Also, **L. C. Adams,** formerly exploration superintendent for the firm's Rocky Mountain Division, has been appointed manager of exploration and transferred to Tulsa. He succeeds **J. C. Johnston** who has been appointed vice president and division manager for the company's Texas-Louisiana Gulf Coast Division at Houston; **William T. Smith** of Fort Worth, has been appointed to the position of division exploration superintendent for the North Texas-New Mexico Division, succeeding retired **William J. Nolte; John R. Evans** has been elected vice president for production and a director, succeeding the deceased **Whitney M. Elias; Phil H. Garrison** has been appointed division exploration superintendent in the Rocky Mountain Division to succeed Adams; **J. W. Brown** has been promoted from area superintendent, Hobbs, N. M., to assistant district superintendent in the Lubbock, Texas, district; **V. E. Staley, Jr.,** replaces Brown at Hobbs; **S. H. Stocker** replaces **F. L. Nabors** as district engineer at Tyler, Texas, Nabors transferred to Farmington, N. M., and **J. E. Krath** has moved to Longview, Texas, as area engineer.

Russell D. Eberly has been promoted to manager of safety in the Central Employes Relations Department of **American Oil Company.**

Herbert Allen, vice president and general manager of Cameron Iron Works, Inc., has been named **"Engineer of the Year"** by the San Jacinto Chapter of the **Texas Society of Professional Engineers.** He received a plaque at a banquet in his honor at the Houston Club on February 24.

NOW

AIR POWERED...

THE VERSATILE

Foster

MODEL 59

DRILL PIPE TONG

DOES THREE BIG JOBS BY RUNNING YOUR

DRILL PIPE, CASING, & TUBING

The air powered FOSTER model 59 DRILL PIPE TONG will speed up your trips, protect your pipe, and make the derrick floor a safer place to work. All this adds up to PROTECTING YOUR PROFITS.

The hydraulic version of this tong was introduced at the IPE in 1959. Its success prompted the development of this air powered tong for rigs already equipped with air compressors. One major oil company has already ordered their second Model 59 air tong to run drill pipe and casing.

Think of stepping up your company's efficiency and profits by contacting us for particulars, TODAY.

Foster **CATHEAD COMPANY**

P. O. BOX 1351 WICHITA FALLS, TEXAS

2101 GRANT ST. PHONE 322-8653

R. D. Cloninger ..... Lafayette, Louisiana
L. W. Mauck ..... Great Bend, Kansas
W. O. Nelson ..... Farmington, New Mexico
Coastal Engineering Co. Bakersfield and Long Beach, California
Moore Sales & Service Company Casper, Wyoming
Joe Perry ..... Salem, Illinois
T. C. McDonald ..... Shreveport, Louisiana
Leidecker Tool Co., Ltd. Edmonton, Alberta, Canada
Langley Y Cia, Srl ..... Buenos Aires, Argentina
East-West Oil Tools C. A. Maracaibo & Anaco, Venezuela
Rooks Oil Field & Engr. Supply Co., Ltd. San Fernando, Trinidad, T.W.I.

SEND FOR YOUR ANNUAL EDITORIAL INDEX NOW

WORLD OIL's annual Editorial Index, covering all the issues published during 1960, is now available to all WORLD OIL readers. Bound in convenient pamphlet form, this handy and useful index will be sent FREE to all subscribers requesting copies. What special issue or article did you forget to save? Well, no need for worry, the 1960 Editorial Index refreshes your memory.

Make sure you get your copy FREE of charge. Address your order to Librarian, Gulf Publishing Company, Post Office Box 2608, Houston 1, Texas. If you prefer, use the convenient Reader's Service Blue Postcard just inside the back cover of this and every issue of WORLD OIL. Just check the square indicated, fill in your name and address and drop postpaid card in the mail. The annual WORLD OIL Editorial Index will be sent to you FREE by return mail. Don't delay. Do it now. The Supply is limited.

Associations

Houston NOMADS Host Foreign Guests
These foreign guests attended the Houston NOMADS regular February meeting when William G. Dudley, publisher of WORLD OIL, headed a panel discussion of the oil industry outlook for 1961. Panel members included Donald E. Kliewer, WORLD OIL editorial director, and editors H. T. Brundage, exploration; Jack F. Earl, drilling, and Robert W. Scott, production engineering. Foreign guests present were (back row, left to right) R. C. Lewis, Texaco Trinidad, Trinidad, B.W.I.; Jack Hays, Arabian American, Saudi Arabia; Andy Almoina, Hughes Tool Company, Maracaibo, Venezuela, and Wes Brandon, Reed Roller Bit Company, Venezuela. Front row (left to right) Dr. Pina, Petrobras, Rio de Janeiro, Brazil; Tom Short, Hughes Tool Company, Maracaibo, and E. L. Calendar, General Supply, Venezuela.

L. F. Davis and J. C. Johnston Named to OIC Positions

Louis F. Davis, newly appointed assistant general manager for The Atlantic Refining Company, Dallas, has been named Northern Texas OIC Regional vice chairman, by the Texas Oil Information Committee, and John C. Johnston, vice president of Pan American Petroleum Corporation, Houston, has been appointed Southern Texas OIC regional vice chairman.

In his new assignment Davis will guide oil industry public relations activities in 78 counties in North and East Texas. He succeeds Hamilton Rogers, executive vice president T P Coal & Oil Co., Fort Worth. Johnston will be in charge of 90 counties in South Texas. He succeeds L. Chase Ritts, vice president Pan American Petroleum Corp., Houston.

Both Johnston and Davis were appointed to two-year terms in the Texas Mid-Continent Oil & Gas Association sponsored OIC program.

New York NOMADS' First Open Meeting
A large number of out-of-town guests were present at the first open meeting held in February by the New York Chapter of NOMADS. Present were (seated, left to right) Leo F. Mermis, Halliburton Company; John P. Waneck, Manning, Maxwell & Moore; Charles Benedeti, C. E. Halaby & Co., Medellion, Colombia; Merritt Halburd, Petroleum Week, Detroit; George Stones, Mitchell Cotts & Co., Tripoli, Libya. Standing (left to right) George F. Clements, Empire Trust Co., New York City, and H. J. Wilson, Creole Petroleum Co., Caracas, Venezuela.

ALVIN PLAZA HOTEL
MAIN AT 7TH

Single $4.75 (without TV)
$5 to $7.50 (with TV)
Double $6.50 to $9.50

Located in downtown Tulsa. All rooms are completely air-conditioned with combination tub and shower, and circulating ice water.

NEW PLAZA CLUB for Hotel Guests
EXCELLENT FOOD — Popular Priced Coffee Shop — Buffet Lunch 11 AM to 2 PM in Tap Room

BANQUET & MEETING FACILITIES for groups of 10 to 250

TULSA
Oklahoma

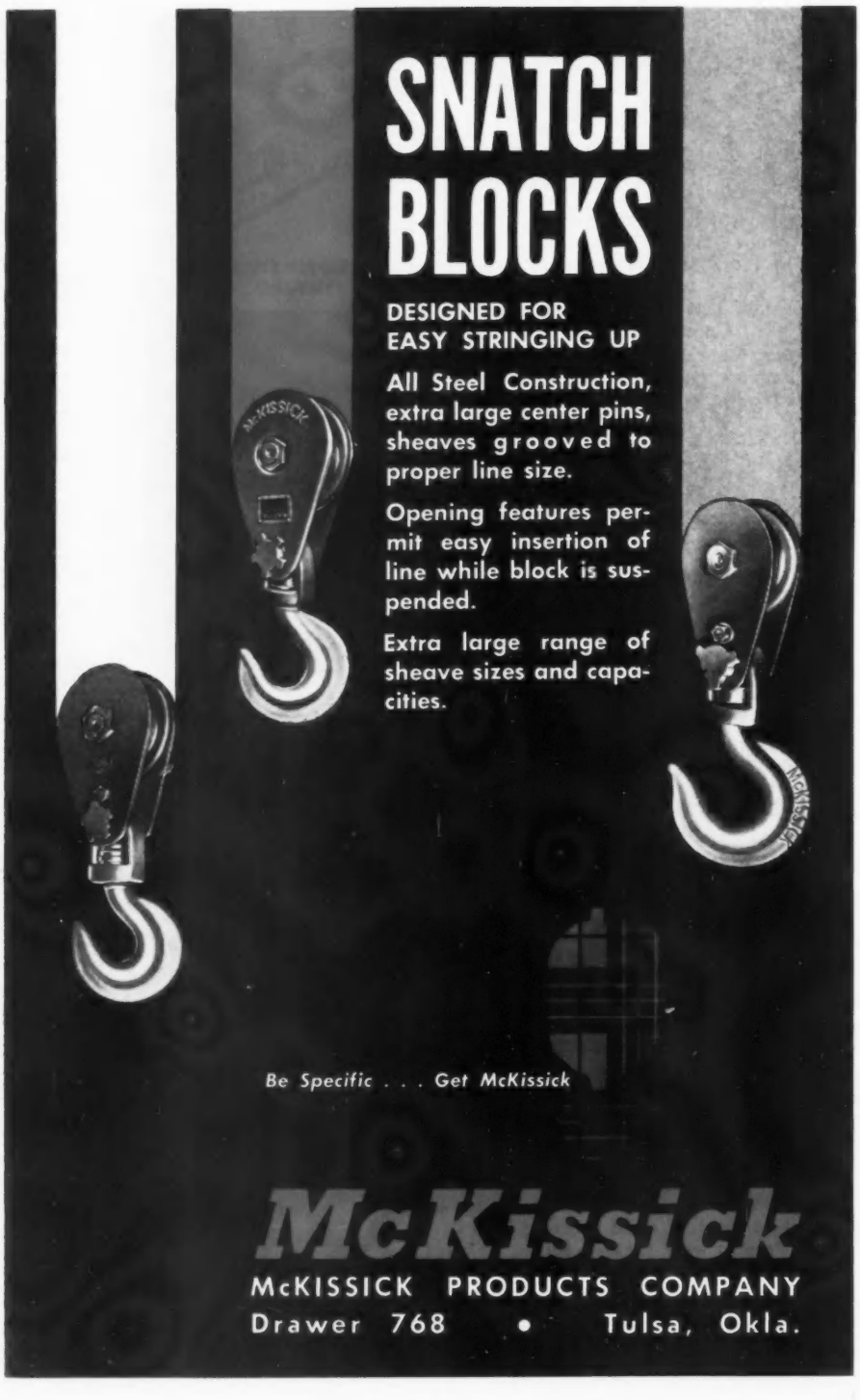
Associations

SEG Sets Theme For April Annual Midwestern Meeting

Geophysics and Economic Oil Finding will be the theme for the Society of Exploration Geophysicists at its fourtenth annual midwestern meeting to be held at the Skirvin Tower Hotel in Oklahoma City, April 9-11.

According to "A History of Exploration Geophysics," prepared by Paul L. Lyons, chief geophysicist for Sinclair Oil & Gas Company in Tulsa: "On June 4, 1921, the first reflection seismograph field party made tests in a stream bed in what is now northwestern Oklahoma City. Party members included such pioneers as Dr. J. C. Karcher, Dr. Irving Perrine, Dr. W. P. Haseman and W. C. Kite. They did not realize that they were right above the greatest oil field in Oklahoma and that the technique they were experimenting with would later be developed into a tool for finding such oil fields all over the world."

Papers to be presented at the technical sessions include such titles as: "How Geophysicists can Meet the Present Economic Situation," "Geophysic's Share of Today's Exploration Dollar," "Technical Limitation of Present Geophysical Tools," "Current Research to Improve Effectiveness of Standard Geophysical Methods." The governor of Oklahoma, J. Howard Edmondson, is expected to address the meeting.


SNATCH BLOCKS
DESIGNED FOR EASY STRINGING UP
All Steel Construction, extra large center pins, sheaves grooved to proper line size.
Opening features permit easy insertion of line while block is suspended.
Extra large range of sheave sizes and capacities.
Be Specific . . . Get McKissick
McKissick
McKISSICK PRODUCTS COMPANY
Drawer 768 • Tulsa, Okla.

M. L. Hill

C. L. Moody

Mason L. Hill Named New AAPG President

Mason L. Hill, manager of exploration, Richfield Oil Corporation, Los Angeles, will become the forty-fifth president of the American Association of Petroleum Geologists on April 27, as announced by Ben H. Parker, president of the association.

Serving with Hill on the 1961-62 executive committee will be J. Ben Carsey, exploration advisor, Humble Oil & Refining Company, Houston, as vice president; Parker, Frontier Refining Company, Denver, past president, and re-elected terms, George V. Cohee, U.S. Geological Survey, Washington, D. C., as secretary-treasurer, and Grover E. Murray, Boyd professor of geology, Louisiana State University, Baton Rouge, as editor.

The new slate of AAPG officers will assume the responsibility of directing the 15,500 member organization at the close of the forty-sixth annual meeting of the association, that will be held in Denver, April 24-27.

Retiring members of the present AAPG executive committee are past president Lewis G. Weeks, consulting geologist, Westport, Conn., and Frank B. Conselman, consulting geologist, Abilene, Texas.

Clarence L. Moody, consultant, Houston, has been named to receive the Sidney Powers Memorial Medal, highest honor in petroleum geology, at the April meeting. Made in recognition of distinguished and outstanding contributions to and achievements in petroleum geology, Moody will be the fourteenth recipient of this award.

A member of the association since 1920, Moody has held the offices of vice president, 1937; editor, 1947 and 1948, and president, 1950. In 1948 he was a delegate of AAPG to the International Geological Congress, London; a Distinguished Lecturer in 1955, and was made an honorary member of the association the same year.

Houston Chapter API Names Vance to Advisory Board

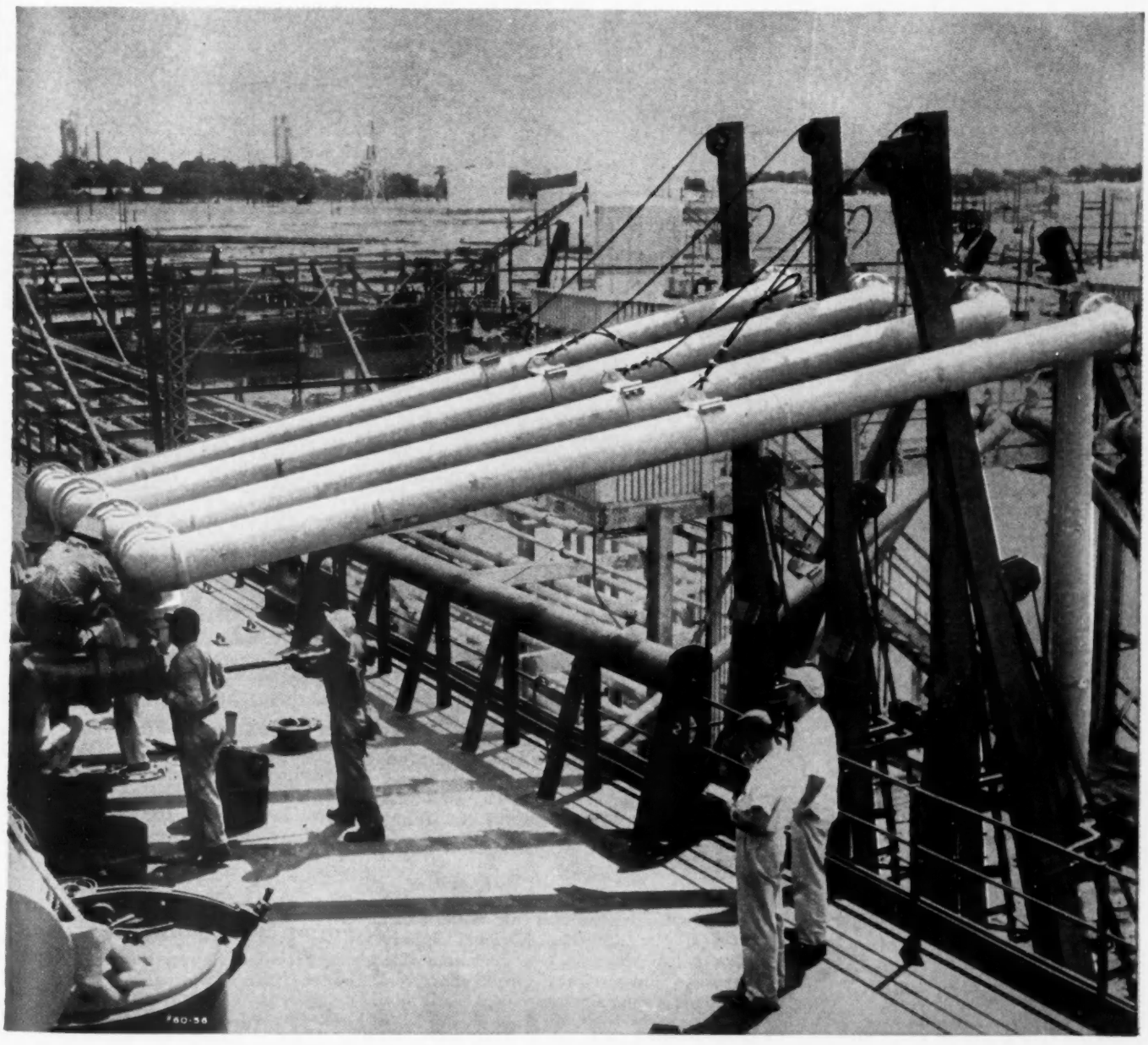
Harold Vance, vice president and manager of the Oil and Gas Department, Bank of the Southwest, has been named to the Advisory Board of the Houston Chapter, American Petroleum Institute for 1961, and has been appointed to serve on the Awards Committee. Vance also has been named to the Finance Committee of the Petroleum Club for this year.

PROOF OF PERFORMANCE at a major gulf coast refinery.

Nothing says customer satisfaction as strongly as a re-order. Since Chiksan sold its first Hydraulic Marine Loading System in 1955, many original customers have re-ordered. They have learned through actual operation that this is the safest, most efficient, most practical method of modern tanker loading. The Chiksan system shown went into service in September, 1959; additional units have since been ordered. For a quotation on a system for your terminal, write Chiksan, Brea, California.

fmc CHIKSAN

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION



! MARTIN RUBBER & DUCK RINGS give excellent life in dirty abrasive fluids . . . high or low gravity . . . much or little water . . . shallow or deep wells. They last for years in the easier pumping wells. Replacement rings cost comparatively little.

! MARTIN PLUNGER BODIES, precision grooved, drilled and threaded (no underneath fluid passage), usually last for years. Tube or barrel costs are often cut in half.

! The replaceable SYNTHETIC RUBBER GUIDES in MARTIN CAGES last longer than any metal, and the cushioning of the ball increases your ball & seat life. Results are often truly amazing. (Patent No. 2,591,174)

Write for our new catalog or see it in the Composite (24th Edition). All products sold thru supply companies.

JOHN N. MARTIN
Manufacturer
9 W. BRADY STREET • TULSA, OKLAHOMA

Suppliers' notes

F. E. Jacobs

J. E. Hodges

Paul Garmany was recently promoted to assistant vice president for credit, property taxes and insurance by **Hughes Tool Company.** Other promotions included **J. E. Hodges** promoted to assistant vice president and will continue to serve as assistant to the senior vice president and as director of planning and coordination. **F. E. Jacobs** was promoted to comptroller, **Oil Tool Division.**

Paul Garmany

William W. (Bill) Green has been named manager of the **Mid-Continent Supply Company** store at Gainesville, Texas. Green was a salesman at the firm's Wichita Falls, Texas, store.

Jarvis Brown has been promoted to sales promotion manager of the **Weatherford Oil Tool Company.** Since joining Weatherford in 1947, Brown has been personnel training director, supervisor of manufacturing quality control and manager of several district sales offices.

John Hall Grubb, vice president and manager of the **International Division** of **Cameron Iron Works, Inc.,** died January 25, in Houston, following an illness of several months. Grubb joined Cameron Iron Works, Inc., in 1955, and for the past two years has been the vice president and manager of the International Division. He was a member of the Houston Chamber of Commerce and the Petroleum Club.

William H. Berno and **Leonard E. Gilmore** have been appointed field sales engineers for **Texas Instruments Incorporated Geosciences & Instrumentation Division's** instrumentation group. Berno has been assigned to TI's Detroit office and Gilmore will service the New England area from the company's New York office.

John D. Mitcham has been appointed plant sales engineer at the Gainesville, Texas, plant of **The National Supply Company.** Mitcham will be responsible for sales and service of torque converters and hydraulic couplings, along with other industrial products.

A. J. Foster has been appointed parts salesman and service supervisor for the Dallas-Midland, Texas, District for **Clark Bros. Co., Division of Dresser Industries Inc.** Foster will headquarter in Albuquerque, N. M., supervising sales in West Texas, New Mexico, and portions of Arizona, Colorado, Wyoming, Idaho and Utah.

Robert L. McCelvey has been appointed manager of the **Electrodynamic Instrument Corporation's** newly created Military Department.

A. S. Rairden, who has been associated with the wire rope industry for more than 35 years, has been named assistant to the president of the **Paulsen-Webber Cordage Corporation,** whose main offices are in New York City. The Paulsen-Webber organization is expanding its sales and service into the oil industry.

Thomas J. Faver has joined the **Tyson Smith Company** as sales manager of the firm's Oil and Gas Division. Faver, headquartering in Houston, will coordinate sales and service of the firm's oil and gas process equipment throughout Texas, Louisiana and Oklahoma.

W. J. Goldston has been appointed to the board of directors of **Tex-Tube, Inc.** Goldston is president of Goldston Oil Corp., and Goldrus Drilling Co. He is also a director of the First City National Bank of Houston and of the Movible Offshore Co. Goldston is a former president of the Mid-Continent Oil and Gas Association.

W. J. Goldston

G. P. Karas

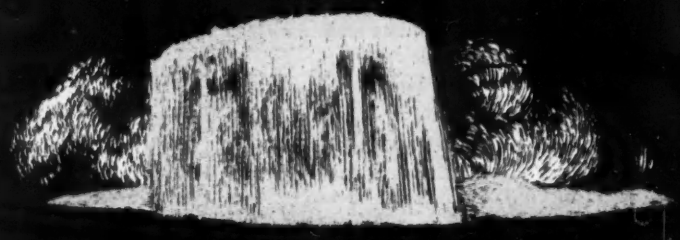
George P. Karas has been promoted to assistant manager of the **Perfex Pak Division** of the **Perfex Corporation.** Karas joined the Perfex organization in 1959 as a sales engineer.

C. B. Black, executive vice president and a director of **Rockwell-Standard Corporation,** has been elected a director of **Aero Commander, Inc.,** wholly owned subsidiary of **Rockwell-Standard.**

Caterpillar Tractor Co. Forms Swiss Subsidiary

Caterpillar Tractor Company has announced the formation in Switzerland of a subsidiary company, Caterpillar Overseas S.A. This subsidiary will take over

VISQUEEZ slurry shuts off water where all other methods fail!



BJ Service

An exclusive BJ Service development, Visqueez is the most effective method yet devised to shut off water from producing oil or gas wells. Only Visqueez slurry *thins* on contact with water... penetrating and depositing cement deep into the most troublesome water-bearing formations. A special viscous carrying agent puts a protective coating around the cement particles. The slurry cannot set up until a *pre-timed* chemical action removes the oil coating. No high squeeze pressures... no need for reverse circulation or costly drilling out—excess slurry is recovered as free-flowing oil and cement. With BJ Service Visqueez, the well is back on production in 24 hours or less!

For complete details, call your local BJ Service field station today.

Results talk!

Visqueez Increases Oil Production 30% — Decreases Water Production 27%

PROBLEM: To lower the water/oil ratio of the producing wells in a water-flood system in Wyoming. SOLUTION: Visqueez was used to treat 16 producing wells with an aggregate production of 10,883 BWPD and 897 BOPD. Following Visqueez treatments, water production has decreased to 7,983 BPD and oil production has increased to 1,169 BPD. Over-all results: water production down 27% — net oil production *up* 30%.

BJ SERVICE, INC.

A BORG-WARNER SUBSIDIARY

Long Beach, California • Arlington, Texas • Stations in all major oil fields

BJ B-W SERVICE

Suppliers' notes

selling and servicing of Caterpillar products primarily outside the Western Hemisphere, according to the announcement. However, in Australia and the United Kingdom, local Caterpillar companies will continue to handle such matters.

Headquarters of the new subsidiary will be in Geneva. Management and certain technical and specilized personnel will move there during the next several months to head the operations. V. V. Grant will be president of the new company; R. H. Deffenbaugh will be secretary-treasurer; J. R. Hawk, sales manager, and G. J. Preston, parts and service manager.

Weir to Manufacture and Market Pacific Valves

Pacific Valves, Inc., Long Beach, Calif., recently negotiated a trade and manufacturing agreement with Weir Valves, Ltd., Glasgow, Scotland, whereby Weir Valves will have manufacturing and marketing rights to Pacific's entire line of valve products.

Weir Valves recently changed its company name to Weir-Pacific Valves, Ltd., and all valves manufactured at the Scotland facilities will carry this designation.

Officials of Weir-Pacific are D. A. Smith, managing director, D. S. Smith, secretary, and D. McDermott, sales manager.

MODERN ENGINEERED GAS LIFT VALVES

Guaranteed Low Cost Maintenance

A Harold Brown Gas Lift Valve is available for every type Gas Lift Installation.

H-B Gas Lift Valve Features:

- Large Dome Capacity
- Stops limit stem travel, protect bellows
- Bellows Support Rings prevent reduction in convolution radius
- Replaceable stem and seats

Normally Closed Check Valves

Three interchangeable types:

- Magnetic cage check valve
- Gravity chcck valve
- Spring loaded check valve

These Superior Features and the Long Wear of H-B Check Valves Make This Possible!

GUARANTEED EXCHANGE POLICY FOR STANDARD VALVES

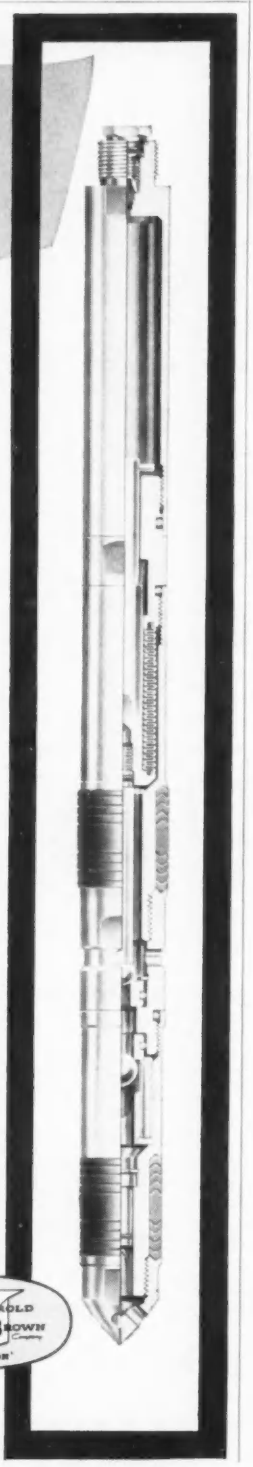
1 year in hole—full warranty against mechanical defect.
2 years in hole—Exchange $25.00
2 to 3 years in hole—Exchange $35.00
3 to 5 years in hole—Exchange $50.00

Slight additional cost for retrievable valves. Also five dollars additional cost outside mid-continent areas.

Ask your Harold Brown Representative for full information on putting highly efficient, low cost H-B Gas Lift Valves in your wells.

HAROLD BROWN COMPANY

P. O. Drawer 25047 • Houston 5, Texas
Phone: JAckson 6-4411



A view of the control panel of Cameron's new 20,000-ton forging press.

Cameron Installs New 20,000-Ton Forging Press

Cameron Iron Works recently installed a new 20,000-ton capacity forging press in its Houston plant. The press, designed and built by Cameron engineers, is complete with auxiliary equipment.

The new press will make possible large size oil industry forgings with controlled and uniform physical properties and in sizes and shapes heretofore impossible. Examples of oil tool forgings which will be produced from the new press include large 12-inch blowout preventer bodies, large forgings for pressure vessels, large size heavy wall pipe for high pressure use, large valve bodies and submarine well completion equipment.

Welex, Inc., Is Made Division of Halliburton

The Halliburton Company, Duncan, Okla., has announced the merger of Welex Inc., Forth Worth and Houston, into Halliburton as the new Welex operating division.

Welex was acquired by Halliburton in 1957, and until now has operated as a wholly owned but independently managed subsidiary. The meger followed the transfer of ownership in October of Welex Electronics Corporation, Washington, D.C., a former Welex Inc., subsidiary, to direct Halliburton control.

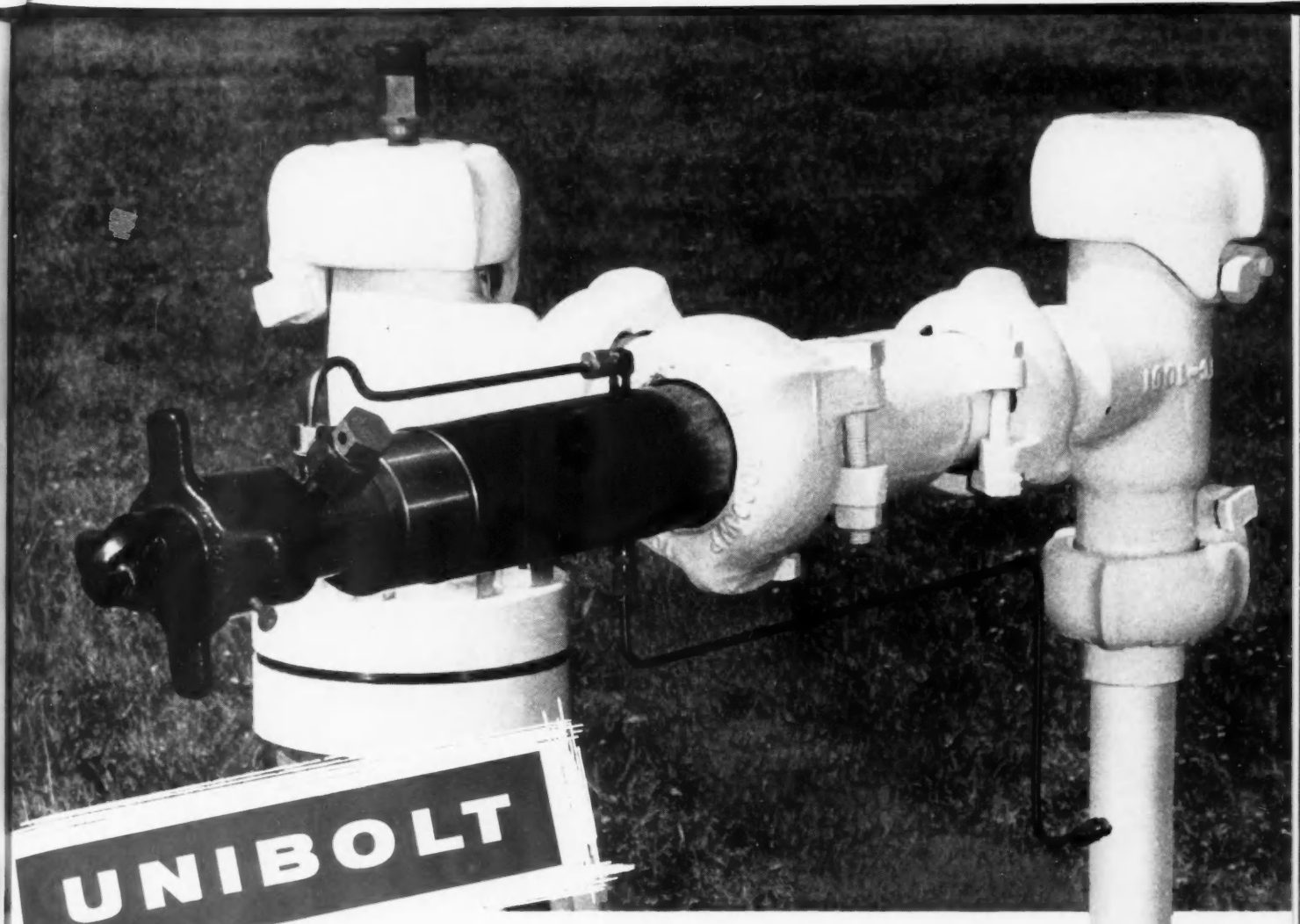
Turner Armstrong, former vice president of Welex Inc., has been named general manager of the division. The company has stated Armstrong is expected to be elected to a Halliburton vice presidency in the near future. Principal offices of Welex will be moved from Fort Worth to Houston, where the division will continue manufacturing activities in its new plant. No personnel changes are planned.

White Motor Constructing New Branch Headquarters

The White Motor Company has announced the construction of a new branch headquarters for White and Autocar Trucks. The building, already under construction, is in Watertown, Mass.

The new headquarters building, ac-

Long Beach, California • Arlington, Texas • Stations in all major oil fields



Pressurematic Valves

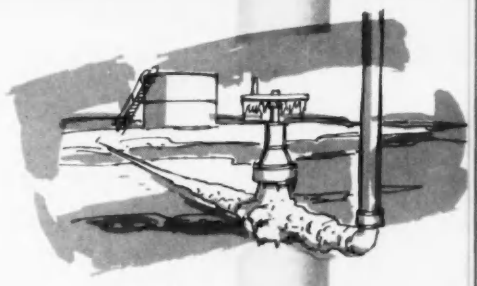
Provide dependable, low-cost insurance against all flow-line hazards

Here is a valve that does the work of two valves yet costs little, if any, more than a good high pressure valve. It is both a high-low safety and a Christmas tree wing valve.

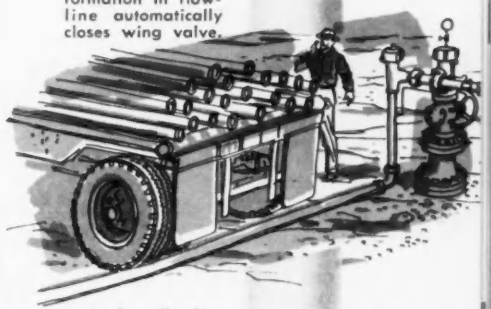
The UNIBOLT PRESSUREMATIC VALVE combines all of the time-tested and proven features of the Unibolt Adjustable Wing Valve with a novel automatic actuating accessory. The valve closes instantly when a predetermined pressure balance across the seat is disturbed. The actuating mechanism consists of a small piston which is exposed to well pressure and a larger piston which is exposed to flowline pressure. A broken flowline or open valve, for example, in the production system, would lower the flowline pressure and thus instantly close the valve. Once closed, the valve may be easily opened and set manually for automatic operation. The downstream or low pressure line may be tapped at any remote point and thus embrace any desired portion of a gathering and treating system. Offshore and other remotely controlled wells could be shut in automatically in case of fire, ship collision, etc. The unique design lends itself to many such applications.

Send for literature or contact your nearest Unibolt sales representative.

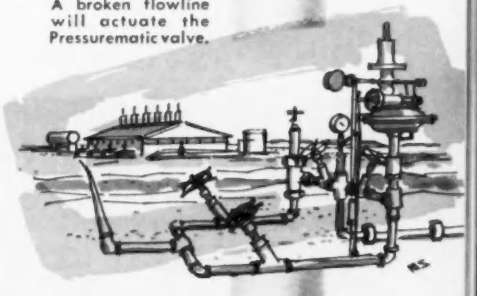
YOU CAN CONVERT YOUR UNIBOLT ADJUSTABLE WING VALVE TO "PRESSUREMATIC."
The regular UNIBOLT Adjustable Wing Valve can be readily converted to "Pressurematic" by replacing the stem/bonnet assembly with the Pressurematic unit.



Freezing or hydrate formation in flowline automatically closes wing valve.



A broken flowline will actuate the Pressurematic valve.



Failure of a pressure regulator on pipe line gathering manifold would shut in the well.

UNIBOLT

THORNHILL CRAVER CO.

P. O. Box 1184, Houston, Texas

cording to the announcement, will have the largest service area for trucks in the New England states. In addition to 46-service stalls, there will be a chassis dynamometer, two complete lubrication areas and one wash area. The building will also house offices, the latest in parts storage and service facilities, a machine shop with specialized equipment and completely engineered building facilities. When completed, the new branch headquarters building will serve as a sales, service and distribution center and will replace the company's present location in Boston.

Frank D. Weaver shown with X-ray Diffraction and Emission Spectrometer unit. X-rays are diffracted from the specimen and measured for quantitative analysis. The new system replaces time consuming wet chemistry methods.

The *New* PROVEN WAY to get the...

BEST CEMENT JOB

SPIN-O-LIZER CEMENT SPINNERS

Manufactured for All Sizes of A. P. I. CASING

SPIN-O-LIZERS take the doubt out of your cementing. Cement Bond Logs and Temperature Surveys have proven on well after well that SPIN-O-LIZERS give a more thorough and uniform cement job.

Avoid damaging your formation by using SPIN-O-LIZERS to eliminate the possibility of having to put a squeeze job on your formation.

★ ELIMINATES CHANNELING
★ REDUCES CONTAMINATION
★ SPACES MULTIPLE CASING STRINGS
★ CENTERS CASING
★ ACTS AS STOP COLLAR
★ MADE OF TENZALOY

Contact your favorite supply store, Clark Oil Tools or their representatives for SPIN-O-LIZERS, Clark Scratchers, Centralizers, and Stop Collars.

CLARK OIL TOOLS

PH. 767-2440, WICHITA FALLS, TEXAS, P. O. BOX 238

REPRESENTATIVES
Roy Manning—Wichita Falls, Texas
Bill Whitaker—Throckmorton, Texas
Kenneth Clark—Alice, Texas
Owen Marsh—Tulsa, Okla.
Ben Bolding—Guymon, Okla.
B & R Service Co.—Farmington, N. M.
Dave Crancer—St. Louis, Mo.
John Raymond—Hutchinson, Kan.
Globe Oil Well Cementing Inc. Great Bend, Plainville, Hill City, and Kiowa, Kansas.

New Laboratory Service Offered by Meta-Chem

Recent scientific advances in dry chemistry are back of the formation of a new type laboratory service, Meta-Chem Laboratories, Inc., which was formed and opened recently in Houston. President of the new firm is Frank D. Weaver.

Opening a whole new field for testing and research, Meta-Chem Laboratories, Inc., will help solve petrochemical and metal product quality control problems, according to Weaver. Newly installed electronic devices include the RCA Electron Microscope, capable of magnification to 40,000 X and the General Electric X-Ray Diffraction and Emission Spectrometer. It is one of five such laboratories in the nation and the first in the Southwest.

International Air Engineering Opens Oklahoma City Office

International Air Engineering, Inc., a Nevada corporation, recently opened an office in Oklahoma City. The announcement also stated that the company plans to open an office in Fort Smith, Ark., in the very near future.

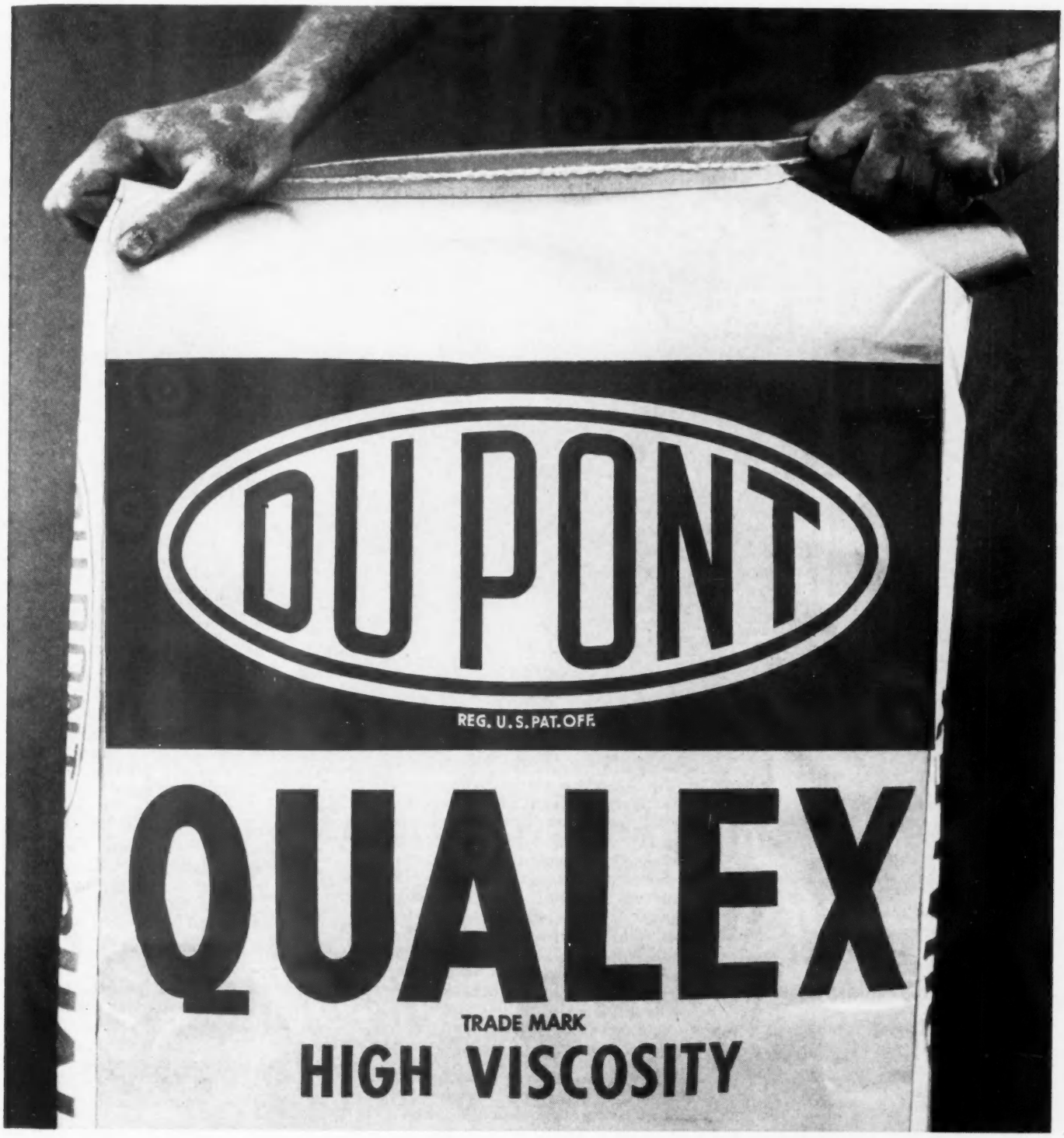
Leo W. Rice is president, George P. Stanison is vice president and Bill B. Rice is secretary-treasurer of the firm serving the oil and gas industry in the field of air drilling.

Allis-Chalmers Announces Department Name Change

Allis-Chalmers Manufacturing Company has announced that the Pump and Compressor Department name has been changed to the Fluid Dynamics Department.

The change in name has been made to more properly identify the company's ability to meet today's requirements for supplying fluid systems rather than just products, according to E. F. Greiwe, department manager.

(More Suppliers' Notes Page 129)

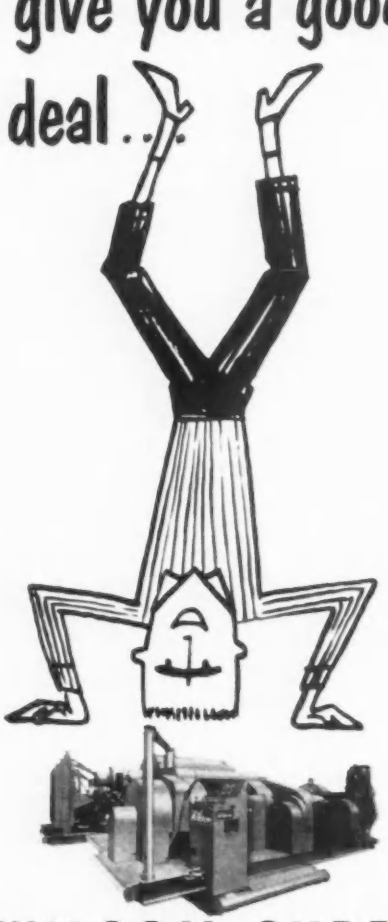


Best way to rip into the high cost of mud in West Texas. Wherever low solids muds are used, as in West Texas and the Rockies, engineers are using DuPont High Viscosity Qualex® 99.5% pure CMC. Because of its extra thickening power, High Viscosity "Qualex" is more economical than competitive products in controlling viscosity at desired fluid loss levels. **DU PONT "QUALEX"**

®Du Pont's registered trademark for its Sodium Carboxymethylcellulose

the technical grade, 72% pure. It's also available in both low and high viscosity forms. Du Pont, 2446 Nemours Building, Wilmington 98, Delaware.

We'll stand on our heads to give you a good deal...



WILSON SUPER ATLAS RIG

See us before you make any deal

- All friction clutch transmission
- Clutches outside the drum
- Full vision panel control

Wilson

WILSON MFG. CO., INC.

Wichita Falls, Texas • The Home of RED IRON

Winchmobiles Traveling Blocks Speedwinches

Slush Pumps 3000' to 25000' capacity Rigs

SQUEAKS

From the Bull Wheel

The Perfect Bait

Customer: "Have you any good after-shave lotion?"

Clerk: "We surely do. Here's a little number that drives the girls crazy. It smells like money."

So—How Come?

How come the television hero can always find a parking space in front of the bank, the supermarket and the post office? (Must be rigged)

Oh, Well . . . Back to Bed

A railroad engineer got up on the wrong side of the bed one morning. His shower water was cold. A shoelace broke. His coffee was weak and his toast burned. His car wouldn't start and he had to take a taxi to work. He was late getting there so he speeded his train up to 90 miles an hour. Just as he swung around a long curve, he saw another train coming at him on the same track.

He heaved a big sigh and turning to the fireman said, "Did you ever have one of those days when everything goes wrong?"

Clever, Eh—These Americans

An American plane developed engine trouble flying over the West Zone of Germany, forcing the crew to bail out. So quickly did they leave that they forgot to take along their two dog mascots.

Somehow the plane headed pilotless into the Russian section and made a perfect landing on a meadow where it was immediately surrounded by Red soldiers.

Moscow leaders are still trying to figure out how the Americans train dogs to fly airplanes.

Way Out West

An Eastern guest at a dude ranch was fascinated in watching a cowboy prepare for himself a smoke. "It's wonderful," he finally remarked, "the way you can roll a cigarette with one hand."

"Tain't nothin," the cowboy responded "Gettin' the filter in is the hard part."

In the Meantime

One young thing to another: "While she's waiting for the right man to come along, she's having a wonderful time with the wrong ones."

Look—While Driving

Scientists say that the average person blinks his eyes 25 times a minute, with each blink average 1/5 of a second. If he drives 40 miles per hour over a 10-hour motor trip, he travels 33 miles with his eyes shut—more proof of the importance of keeping your eyes on the road.

WORLD OIL

"I know you've had great success with your offshore rigs but, good heavens, dear—"

The Merchant Is Always Right

A bewildered Englishwomen wandered into an American grocery store and asked for a small box of detergent. The clerk handed her a package marked "Large."

"I'm afraid you don't understand," the British woman said. "I asked for a small box."

"That's right, lady," was the answer. "It comes in three sizes—Large, Giant and Super. I gave you the small size—Large."

He's No Apestronaut

An ape went into the bar, ordered a scotch and soda and gave the bartender a $10 bill. The bartender assuming the ape wouldn't know the difference handed back a 50 cent piece in change. After a while he got curious about his customer. Leaning over the bar he remarked, "We uh, don't see many apes in here these days."

"No," said the ape, "and at $9.50 a drink, I can understand why."

From One Who Knows

It isn't true, as the saying goes, that alcohol and gasoline don't mix. Actually they do mix, but they taste terrible.

A Scheming Team

Woman trying on mink coat to sales girl: "If my husband doesn't like it, will you promise to refuse to take it back?"

That Was No Fairy Tale

One wolf to another, "Who was that cute little redhead I saw you outwit last night?"

OVER 9″ OF PENETRATION IN HARD BEREA SANDSTONE

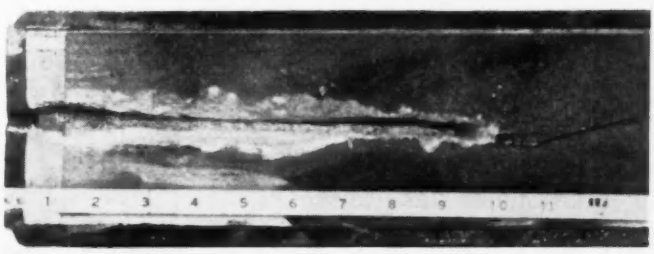
Two more powerful, deeper penetrating Glass Jet Units are now available from McCullough. They are improved Super Casing Glass Jets carrying 25 and 35 grams respectively and are run in flexible Steel Strip Carriers to perforate 4″ OD casing and larger.

In tests conducted in standard Berea Sandstone targets, penetration for each size was greater than ever before achieved – more than 9″ in these very hard targets and with excellent well flow index.

McCullough Glass Jets are the only expendable jet charges that are relatively junk free. When fired they disintegrate into a harmless powder of silicon and lime. No carrots are formed. Fragments of junk, usually associated with other expendable jet perforators, are eliminated. The Steel Strip Carrier is removed from the well after the gun is fired on the electric wire line.

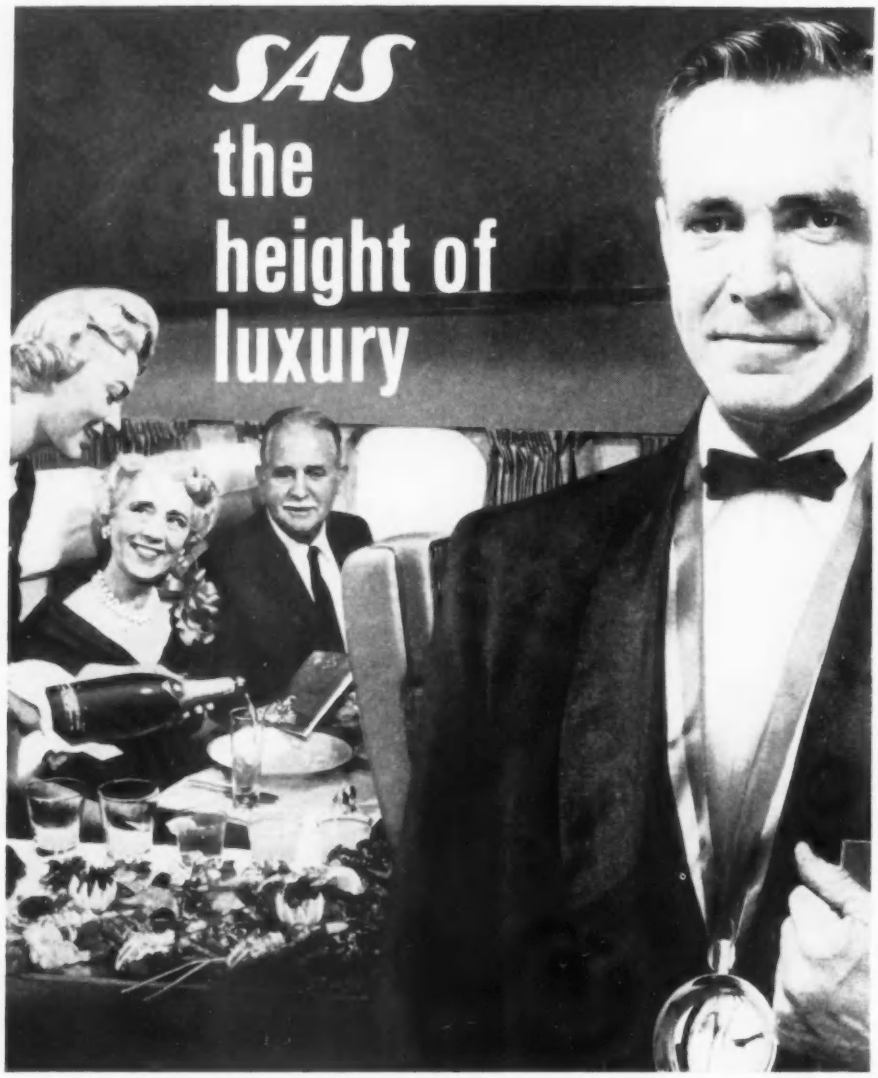
For deeper penetration – peak production – use improved McCullough Super Casing Glass Jets on your next job.

The 25-gram Super Casing Glass Jet is available in 3¼″ OD and 3¾″ OD gun diameters. The 35-gram size is furnished in 4″ OD and 5″ OD diameters. Perforators may be any length required to perforate several intervals on one run in the well. This is accomplished by leaving blank sections in the length of carrier where perforating is not required.



Standard Berea Sandstone target perforated by 25-gram improved Super Casing Glass Jet at ½″ clearance. Average penetration of a series of tests – 9.312″. Average entrance hole size – 0.375″. Pressure rating – 20,000 psi. Temperature rating – 300°F.

McCullough
TOOL COMPANY
Los Angeles • Houston • Edmonton
Cable Address: MACTOOL



TO EUROPE...TO THE MIDDLE EAST

Abadan • Dhahran • Baghdad • Teheran • Beirut

When a business trip takes you far from home, you deserve all the comfort and luxury air travel can offer. With SAS, you jet transatlantic or transpolar on a giant DC-8C . . . you enjoy added personal attention from a Maître de Cabine (shown here) exclusive with SAS . . . you whisk through Europe and the Middle East on an SAS Caravelle, world's quietest jet . . . and during your entire flight you enjoy cuisine so magnificent it has been awarded the coveted La Chaîne des Rôtisseurs.

Your SAS travel agent arranges everything.

FIRST OVER THE POLE
SAS

SCANDINAVIAN AIRLINES SYSTEM
638 FIFTH AVENUE, NEW YORK 20, N. Y.
Please send me fact-folders on World Travel.

Name_____

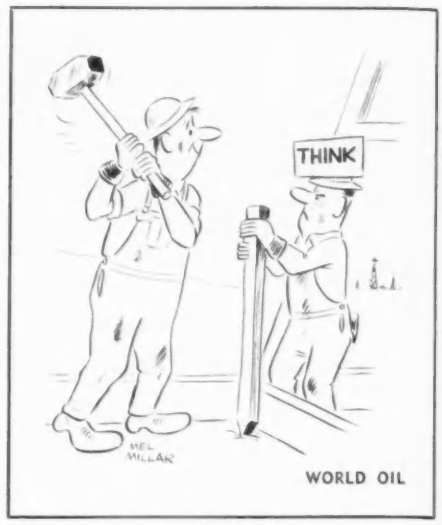
Address_____

Street_____ State_____

My SAS Travel Agent is_____

WO-31

SAS—GENERAL SALES AGENTS FOR GUEST AEROVIAS MEXICO, IRANIAN AIRWAYS AND THAI INTERNATIONAL.



It's All in the Mind

During a fire in the night, the tenants of an apartment hotel rushed into the street carrying their prized possessions. One woman noticed that the gentleman who lived directly above her was carrying a large covered bird cage.

"What have you there?" she asked out of curiosity.

"That's my pet rooster," said the man.

The woman gasped and fainted. When she was revived she told her anxious neighbor, "I'm sorry I fainted but you see I've been under treatment by a psychiatrist for the past year because I kept hearing a rooster crowing!"

Interior Secretary Stewart L. Udall of Arizona was quoted in the HOUSTON (Texas) POST on February 8 as calling for the oil industry to accept the inevitable involvement of government in the industry and that a national policy on oil and gas and fuels must be set.

(Editor's note: We didn't know whether this should appear under "squeaks" or the "Obituaries.")

Quiet Pleeeeze

Sign in a hotel shower: "Keep that song in your heart—these walls are thin."

SECONDARY RECOVERY

PETROLEUM ENGINEERS
STEPHENS ENGINEERING
WICHITA FALLS, TEXAS

RESERVOIR ENGINEERING
Water Flooding Gas Repressuring
EVALUATION CORE ANALYSIS
SURVEYS ECONOMICS
Cost Estimates, Design, Installation
FIELD SUPERVISION
Phone 723-2167

Suppliers' notes

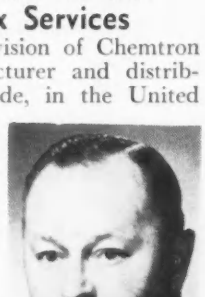
Reed and Dresser Boards Agree on Acquisition Plan

The board of directors of Reed Roller Bit Company and Dresser Industries, Inc., have agreed in principle on a plan under the terms of which Dresser will acquire the business and assets of Reed as well as assume its liabilities upon the issues of 477,050 shares of Dresser common stock, according to Roy O. Shaffer, president and chairman of the board of Reed Roller Bit Company. This is the equivalent of issuing seven shares of Dresser stock for 10 shares of Reed presently outstanding.

Attorneys for the companies are preparing a formal agreement covering the transaction which is contingent upon arproval of the definitive agreement, upon the favorable opinion of legal counsel of both companies, and approval of Reed stockholders.

Chemtron's Cardox Division Organizes Oildex Services

Cardox (CO_2) Division of Chemtron Corporation, manufacturer and distributor of carbon dioxide, in the United States, recently announced formation of a division to make available carbon dioxide, storage and injection equipment to the oil and gas industry, under the name of Oildex Services.



A. G. Wright

A. George Wright has been appointed manager of field engineering. O. A. Brightwell, Jr., is manager of national sales and engineering. Offices of the new division are in the Rowan Building, Fort Worth.

Oildex Services will supply Cardox carbon dioxide storage and injection equipment to oil producers engaged in secondary waterflood oil recovery programs, under a rental, lease or contract sales plan.

Lightnin Mixers, Ltd., Recently Formed in England

The Mixing Equipment Company, Inc., Rochester, N.Y., and Stockdale Engineering Company in England, have announced the recent formation of a new company in Poynton, Cheshire, England, to manufacture and distribute the complete line of Lightnin industrial mixers in the European market.

The new company will be known as Lightnin Mixers, Ltd., according to the announcement, and will employ Mixco's extensive technological and engineering resources in conjunction with Stockdale's engineering, manufacturing and distribution facilities to market mixing equipment to all process industries utilizing fluid agitation.

Through its location in England, Lightnin Mixers, Ltd., will be able to service foreign customers on a more direct basis than was possible through Mixco's Rochester offices, the announcement said.

WORLD OIL'S Trading Post CLASSIFIED ADVERTISING

RATES: Regular Classified (undisplayed) set in this size type: 20 cents per word. Minimum charge $4. Blind box address in our care counts six words. Replies forwarded without charge. **Display Classified ads,** set in suitably larger type with ruled border, $13.50 per column inch. Ten percent discount for two or more insertions of same copy in consecutive issues. **All classified ads payable in advance.** Send copy and checks to: Trading Post Classified Section, World Oil, P. O. Box 2608, Houston, Texas.

FOR SALE

HANNIFIN HYDRAULIC CYLINDERS—NEW

5—8″ bore 108″ stroke clevis mount
1—4″ bore 8½″ stroke, 2000 PSI, flange mount
2—6″ bore 23″ stroke, 2000 PSI, double ended
3—4″ bore 3⅝″ stroke, 2000 PSI, flange mount
6—5½″ bore 7″ stroke, 2000 PSI, flange mount
3—5″ bore 2¾″ stroke, 2000 PSI, flange mount
6—7″ bore 3″ stroke, 2000 PSI, flange mount

COMMERCIAL SHEARING CYLINDERS—NEW

2—Telescoping, 60″ stroke, Chrome Plate Sleeves 1½ N.P.T.

GARDNER DENVER MUD PUMPS—NEW

1—5″ x 12″ Cast Steel, Fluid Ends Only
2—5″ x 12″ Alloy Iron Mud Pumps

Geotronic Survey Company
27230 Princenton-Inkster, Michigan
Telephone Logan 5-7774

LEASES, DRILLING, ACREAGE, ETC.

Producing Lease—Ivanhoe Dome Field Central Montana Tyler Production

SEALED BIDS will be received by the undersigned until 2:00 o'clock P.M., Friday, March 31, 1961, for purchase by cash of 100% of the working interest of five (5) Tyler sands wells (presently producing approximately 220 BOPD and miscellaneous personal property constituting and located upon the following:

All of Section 16, T-11N, R-31E, Musselshell and Rosebud Counties, Montana, containing 640 acres, more or less.

Additional information may be requested from or inspected at 803 Midland Bank Building, Billings, Montana.

The right to reject any or all bids is reserved.

Final decision with reference to the disposition of the bids will be made within fifteen (15) days of the opening.

Upon acceptance of any bid the applicant must tender a certified check in the amount of $10,000.00 within five (5) days of notification of acceptance. Balance upon title clearance.

J. V. Montalban, Receiver for R. P. Oliver Ltd., 803 Midland National Bank Building, Billings, Montana

NOTICES, SERVICES

■ Oil Field Tools and Equipment Sales Representation for American manufacturers, offered for Italy and North Africa especially, by Italian Engineer, retiring from large Company. Highest References Italy and U. S. Address Box No. 221-W, c/o WORLD OIL, Houston, Texas.

■ FINANCIAL—Investment Banking Houses and Underwriters reached. Confidential. You can send the details of your proposition direct or thru your attorney to Consultant 817 - 51st Street, Brooklyn, N. Y.

FOR RENT

ALDRICH PLUNGER PUMPS
Skidded with Drivers
Available for RENTAL
POWER SPECIALTY CO.
2000 Kipling St.
HOUSTON 6, TEXAS

■ FOR LEASE—4267 fee acres, Apache County, Arizona. Near Pinta Dome proven Helium reserve. $10 per acre. Bob Muse, Box 550, Kilgore, Texas.

HELP WANTED

Chemical Engineers

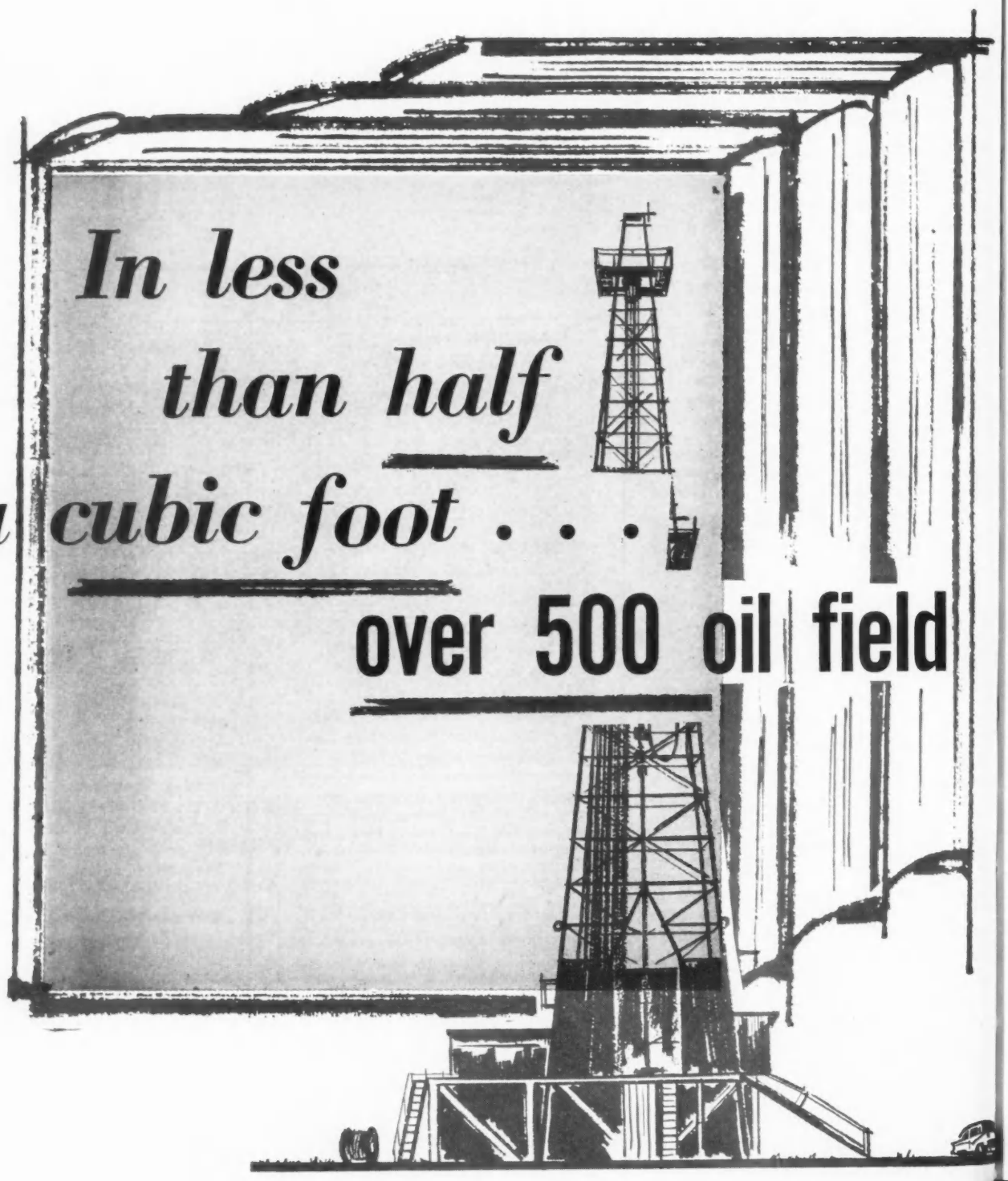
BS or MS degree plus 2 to 5 years experience. Outstanding opportunities for professional development and advancement with a growth-minded company. Process design, technical service and economic evaluations related to petroleum refining and peterochemical processes. Submit resume to:

Manager Coordination and Technical Department

COSDEN PETROLEUM CORP.
BIG SPRING, TEXAS

Join Over 26,000 Key Oil Men

Who receive WORLD OIL each month via a personal subscription. Benefit from the wealth of exploration, drilling and production ideas WORLD OIL regularly contains. See for yourself how WORLD OIL reduces the vast reaches of global oil, and its ideas, to a neat package you can hold and flip-snip, clip and file at will. Subscribe now.

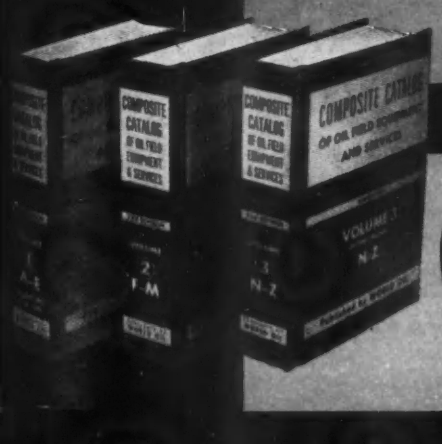

In less
than half
a cubic foot . . .
over 500 oil field

Whether you want absorbers or yokes, or some special oil field service, your quickest, best source of information is the COMPOSITE CATALOG OF OIL FIELD EQUIPMENT AND SERVICES.

In this three-volume, biennially revised reference work, more than 500 manufacturers list over 100 times that many products and services. You can get – in one quick look into COMPOSITE CATALOG – complete descriptive and comparative data on any oil country product or service.

equipment-service catalogs

The next time you buy, specify or compare oil field equipment or services, reach for your copy of COMPOSITE CATALOG. You'll save both time and money.



COMPOSITE CATALOG

Published by WORLD OIL

GULF PUBLISHING COMPANY • BOX 2608 • HOUSTON 1, TEXAS • JA 9-4301

World's Largest Specialized Publisher to the Oil Industries

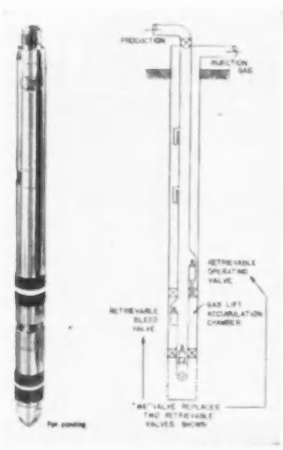
Branch Offices: New York, Chicago, Cleveland, Tulsa, Dallas, Los Angeles

NEW equipment and services

Rotary Drilling Hose

A new brand of rotary drilling hose so high in quality that it goes, according to the manufacturer, beyond the highest standards ever set by the API, is now available. Hose, S - B - C Crown, is constructed with four spirally wound plies of heavy steel wire to withstand the highest pressures encountered in drilling. Two other grades of rotary hose, as well as a mud suction hose and a vibrator hose also are available. (Skinner Brothers Co. Supplements data on Pages 5028-5031, 1960-1961 Composite Catalog).

For more data, circle E1 on postcard



Wire Line Gas Lift Valve

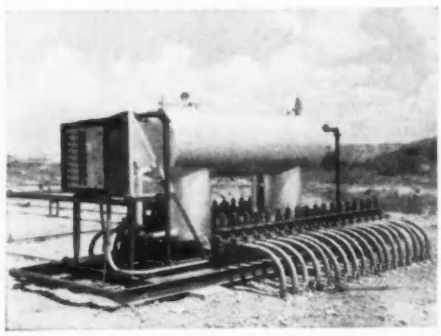
Rapid venting of accumulation chambers in gas lift wells through a half-inch vent port and positive regular gas lift valving through its 1 1/16-inch main port is now possible with this new "WE" wire line gas lift valve that does two jobs at the same time. The WE is used in MME side pocket mandrels. To convert existing accumulation chamber installations to the WE, it is only necessary to retrieve the lower gas lift valve and replace it with WE. Existing vent valve does not need to be removed. (Harold Brown Company).

For more data, circle E2 on postcard

Cementing Equipment

New circulating filrite cementing equipment makes possible a nonstop casing run without pressure surges but still permits full downward circulation when necessary has been developed. The equipment has no depth limitations. Resilient diaphragm permits a continuous but restricted bottom-fill which is sufficient to maintain adequate casing fill without overflow. Flapper valve is maintained in open position by an aluminum retaining bar which is held in place with a shear screw. (Larkin Packer Company, Inc. A Division of Koehring Company. Supplements data on Pages 3241-3244, 1960-1961 Composite Catalog).

For more data, circle E3 on postcard



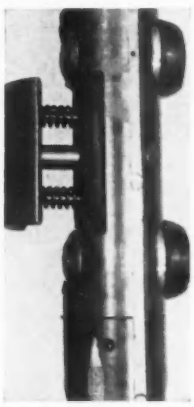
Well Test Unit

This new National packaged well test unit automatically diverts fluid from wells, then separates, measures and records production by using pneumatic operating Mani-Flo valves. Strip chart recorder indicates if well is flowing and/or surging, best production hours, proper operation of pumping well and accurate well performance. Any power failure diverts all valves to production and any or all wells can be shut in manually. (National Tank Co. Supplements data on Pages 3977-3996, 1960-61 Composite Catalog).

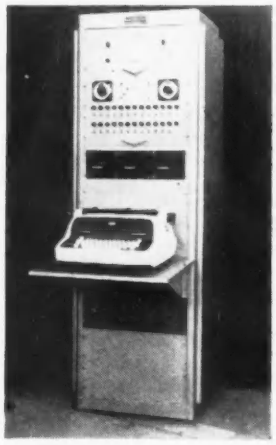
For more data, circle E4 on postcard

Wireline Formation Tester

This wireline formation tester, recently added to the Schlumberger line, operates efficiently in 7-inch or larger casing through a single perforation. It tests through two perforations spaced 8 inches apart and is of smaller diameter to make it applicable in casings of 5½ inches and larger. Advantages: gas-oil and oil-water levels located with pinpoint accuracy; mud damage to formation is minimized because entire formation face is not exposed. (Schlumberger Well Surveying Corp. Supplements data on Pages 4849-4868, 1960-1961 Composite Catalog).



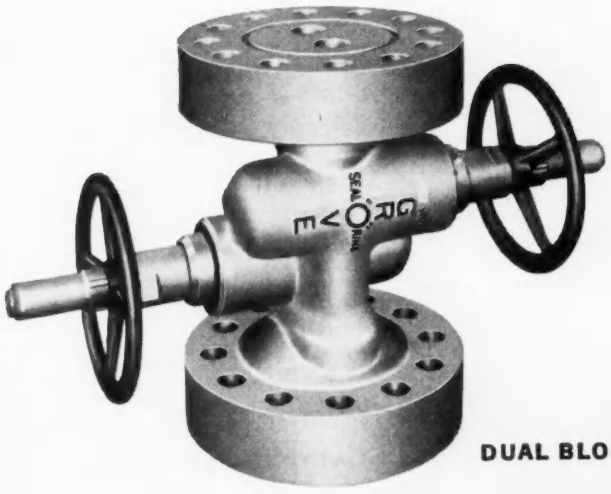
For more data, circle E5 on postcard



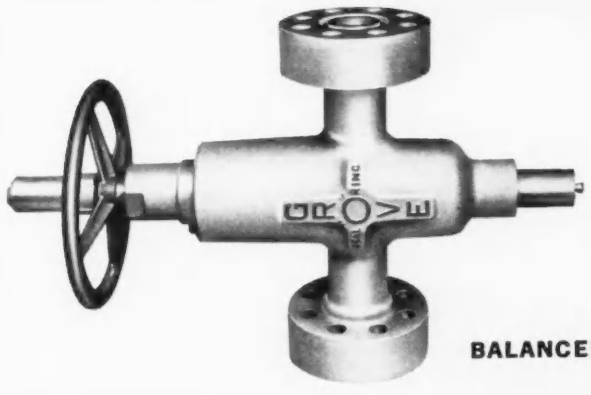
Well Testing System

A fully automatic well testing system designed to simplify and greatly reduce the time required for this activity in the field is now available. Unit is said to embody new principles and conveniences not hitherto used. Called Model WT-300, system is designed to determine the oil, gas and water produced in the individual wells in a group of 25 or any multiple of

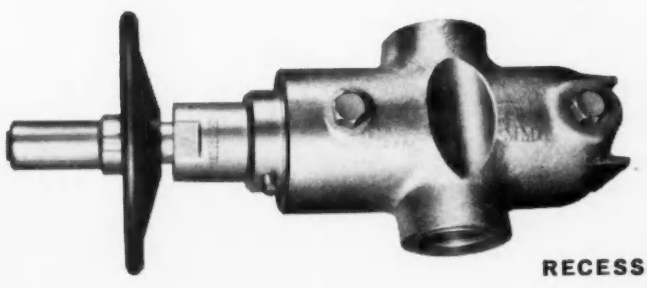
GROVE G-2 SEAL "O" RING® GATE VALVES FOR PRODUCTION AND FLOW LINE SERVICE



DUAL BLOCK



BALANCED STEM



RECESSED BODY

GROVE PRODUCTION VALVES

GROVE VALVE AND REGULATOR COMPANY

a subsidiary of Walworth

Oakland 8, California

Offices throughout the U.S. and in Western Canada

GROVE SEAL O RING

For more data on advertised products, use Readers' Service Cards, last page.

New equipment

25. Features: Each well module is equipped with a purge time, test timer and skip-test well selector switches, rack mounted with pull-out drawers and complete automatic control of all multiple testing functions. (Instruments, Inc.).

For more data, circle E6 on postcard

Front Axle Duals

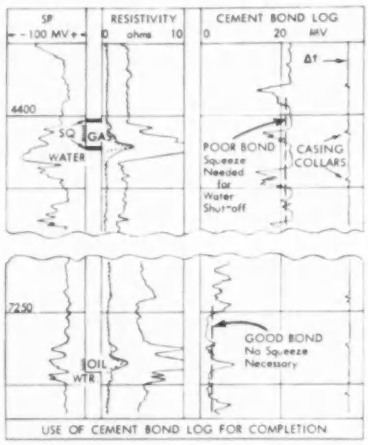
Two front axle duals, featuring independent front wheel rotation, are now available as optional equipment on the manufacturer's Model KM 250 and KM 210 drive-in units used for drilling, servicing, workover and completion. Unique, independent wheel rotation allows each wheel to turn at a different speed, thus eliminating drag and tire wear while maintaining the maneuverability of single wheel axles. A system is provided for equal breaking on all wheels. (Cardwell Manufacturing Co. Supplements data on Pages 1217-1248, 1960-1961 Composite Catalog).

For more data, circle E7 on postcard

Hardfaced Coupling

Availability of a hardfaced coupling for sucker rods has been announced. Consisting of a fused nickel-chromium-boron alloy, the hardfacing is applied to the entire exterior of the coupling, rather than in bands, in order to obtain maximum corrosion protection. Because this hardfaced coupling has a lower coefficient of friction than hardened steel, it is expected to cause less wear on tubing than a standard coupling. (The National Supply Company. Supplements data on Pages 3849-3976, 1960-1961 Composite Catalog.)

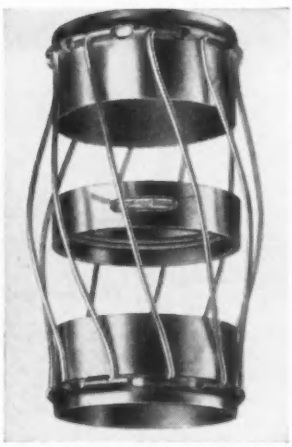
For more data, circle E8 on postcard



Cement Bond Log

This Cement Bond Log, according to the manufacturer, presents for the first time a recording of the quality of the casing cement job. Operation of the service is based on the fact that energy of a sonic pulse transmitted along a casing diminishes rapidly where the casing is bonded to material, such as hardened cement, which has a sonic velocity much lower than that of the casing. Pointing to intervals where bonding is incomplete, even lacking entirely, log indicates channeling and gaps in cement column which require squeezing. (Schlumberger Well Surveying Corp. Supplements data on Pages 4849-4868, 1960-1961 Composite Catalog).

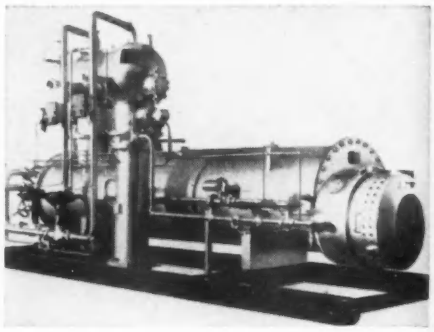
For more data, circle E9 on postcard



Spiral-Flo Centralizer

This improved model to replace its centri-flo centralizer has been placed on the market by the manufacturer. Its spiral construction diverts or whirls the cement, helping to break up channeling. The new model is designed to run in very close tolerances. Thorough field testing had demonstrated the spiral-flo's advantages, including reduced frictional drag and self-cleaning properties. (Weatherford Oil Tool Co., Inc. Supplements data on Pages 5580-5584, 1960-1961 Composite Catalog).

For more data, circle E10 on postcard



Wellhead Production Unit

A new dual wellhead production unit that processes two separate wellstreams simultaneously has been introduced. The Free-O-Freez "Double Dip" unit consists of two spherical separators integrally mounted on one indirect fired heater. It has all the advantages of the single Free-O-Freez unit, including continuous trouble-free cold weather operation. Wellstream is preheated in the heater flow coil before choking to prevent hydrate formation in the separator. (Black, Sivalls & Bryson, Inc. Supplements data on Pages 685-704, 1960-1961 Composite Catalog).

For more data, circle E11 on postcard

Detergent and Bit Lubricant

Drillezz is a blend of non-ionic surfactants to which a metal protecting chemical is added as well as sufficient water to ensure pourability under most conditions. Chemical added to Drillezz ensures that besides the high lubricity the metal parts in contact with the mud will also be protected. This applies in particular to freshly exposed metal surfaces, such as the surface of the bit bearings in abrasive muds. Drillezz is non-foaming although it does not contain any defoamers. This is achieved by the use of a suitable alkyl end of the molecule. (Red Adair Chemical, Inc.)

For more data, circle E12 on postcard

ATTACK EMULSIONS

. . . with these Halliburton Surfactants

HALLIBURTON HYFLO . . . a special blend of surfactants designed for production improvement where either a water block or emulsion block exists. Entering with the fracturing oil, Hyflo tends to destroy these blocks, lowering breakdown pressures of the fracturing treatment. Hyflo is also used with native crude to break up water blocks and water-oil emulsions near the well bore to help increase production.

MORFLO II . . . Similar in action to Hyflo. However, it is most often used in an aqueous or acid carrier. Some applications are – a conditioner for maintaining compatibility in water-base fracturing fluids . . . a component in Mud Cleanout Agent and Mud Flush . . . and as a treating agent for water used in killing wells.

WATER REMOVAL

. . . a job for HOWCO-SUDS

HALLIBURTON HOWCO-SUDS . . . now available in liquid or stick form and designed to be used – for helping remove water from partially drowned gas wells . . . to speed up recovery of water after Waterfrac treatments . . . as a surfactant in acidizing gas wells, injection wells, and disposal wells . . . as an aid to purging water in air and gas drilling. Howco-Suds is also a good lubricant in water which helps extend the life of swab cups.

FLUID CONTROL AGENTS

. . . and three good ways to regulate fluid movement

WAC-8 . . . a Halliburton chemical agent used with all types of acid and water base fluids to lower the loss of fluid to matrix permeability along a fracture crevice. This allows deeper lateral penetration of the treatment.

TEMGEL . . . a hydrocarbon base fluid with delayed gelling action for placement. The material is designed to revert to a thin liquid after a pre-determined length of time. Its composition is compounded for each well depending on well conditions. This mixture will aid in eliminating "thief zones." It can be used in stages to obtain a more even stimulation treatment throughout a productive zone.

TLC . . . a temporary lost circulation compound, is useful in sealing and bridging fractures allowing treating fluids to be deflected into less permeable sections. It is very often used in stages of a stimulation treatment.

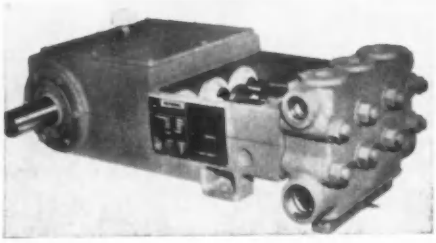
Halliburton has an unequaled selection of chemical solutions to downhole problems. For help with your well problems, see your Halliburton man.

CHEMICAL SERVICES

Halliburton

COMPANY . DUNCAN, OKLAHOMA

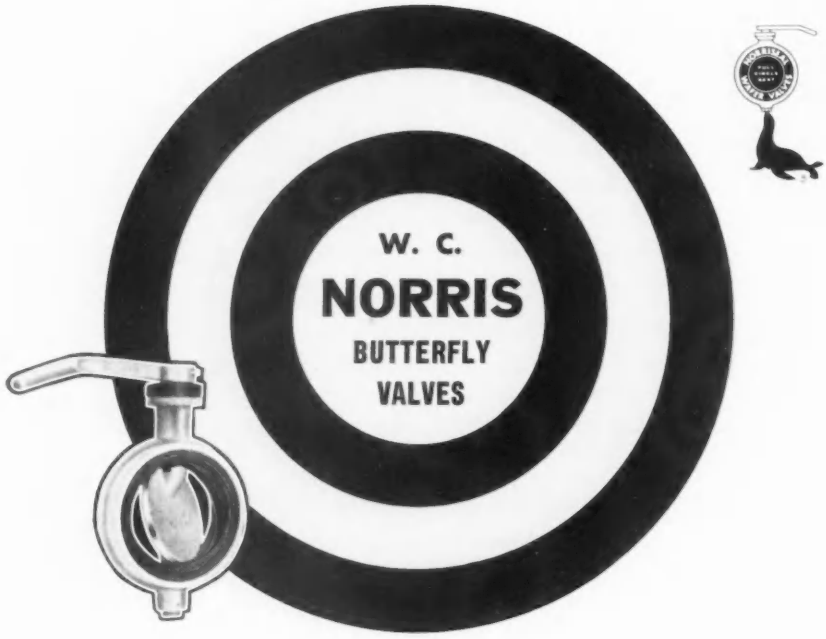
New equipment



New Triplex Pump

A new horizontal triplex pump rated at 50 input horsepower has been made available. It is a plunger type pump designed for many applications such as water flooding, salt water disposal and power oil service. Known as the National J-50 Triplex, it is available in two models: the J-50 L and J-50 M for low and medium pressures in corrosive and non-corrosive service, and the J-50 PO for power oil service. Full cylindrical crossheads provide maximum bearing area for long life. (The National Supply Co. Supplements data on Pages 3849-3976, 1960-1961 Composite Catalog).

For more data, circle E13 on postcard



Target

Versatility-Economy

Now you can reduce costs and simplify valve specifying by using the highly versatile and economical Norriseal Wafer Type Butterfly Valve. Designed for working pressures to 150 psi, the Norriseal Valve features removable and interchangeable rubber and metal seats . . . takes up less line space . . . can be easily and quickly removed for "on-the-spot" maintenance . . . is field repairable. The wide selection of trim available qualifies the Norriseal Valve for use in many oil field and industrial applications.

Write for prices and complete literature today!

BUY FROM YOUR NORRIS DISTRIBUTOR

NORRIS QUALITY Butterfly Valves

W. C. NORRIS DIVISION
DOVER CORPORATION
P. O. BOX 1739 • TULSA, OKLA.

BRANCHES: Great Bend, Houston, Kilgore, Odessa, Wichita Falls, Salem, Casper, Farmington

Insert Pump Anchor

This new insert pump anchor is a simple, easily set, dependable anchor which allows setting a pump anywhere in the tubing string without pulling the tubing to provide a seating nipple or shoe. Type RP is available in 2-inch 175Fl, 2½-inch 225Fl and 3-inch 275Fl sizes. Pump may be located above in cases where the seating nipple or shoe is too deep or inoperative. Reciprocating-set action of the anchor eliminates the need of a clutch in the pump. (Guiberson Corporation, One of the Dresser Industries).

For more data, circle E14 on postcard

Buttress Thread Casing

Buttress Thread Casing has been recently added to this steel company's product lines. It is available in standard sizes, weights and grades and gains its extra strength from the longer length of threads on casing and the reduced flank angle of engaged threads. Design provides the benefits of rapid stabbing and spinning to get a power-tight position. Since there is no internal upset, inside, clearance is the same throughout the string. (Pittsburgh Steel Co. Supplements data on Pages 3393 & 4501-4520, 1960-1961 Composite Catalog).

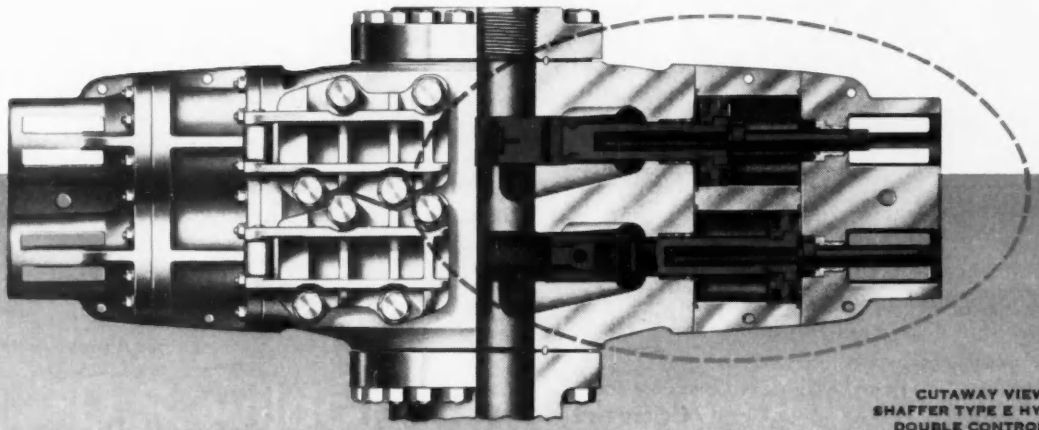
For more data, circle E15 on postcard

Globaloy Mill Shoe

Designed for milling up stuck fish in conjunction with the Globe junk basket for fast, dependable recovery of all the loose pieces in the hole,

WHEN YOU BUY BLOWOUT PREVENTERS

GET SHAFFER "IN-LINE" POWER DRIVE ...IT'S POSITIVE!



CUTAWAY VIEW OF SHAFFER TYPE E HYDRAULIC DOUBLE CONTROL GATE SHOWING "IN-LINE" POWER DRIVES

WHAT IT IS... In Shaffer Blowout Preventers there is no complicated system of levers, rods and linkages connecting the rams with the hydraulic pistons that operate them.

Instead, each Shaffer ram and its operating piston is on a *single* stainless steel shaft that is fully enclosed within the body of the Preventer. When the piston moves the ram moves. There are no complex connections to jam, freeze or otherwise jeopardize positive action!

WHY IT'S BETTER... By eliminating levers that rock, connections that rotate and exposed linkages that move, you eliminate potential trouble spots that can interfere with quick, *positive* action when emergencies threaten.

- Shaffer Preventers give you the simplest, most trouble-free ram and piston design it is possible to build—with both the ram and its operating piston on a *single* shaft—and no complicated connections in between!
- Pressure seals are also reduced to a minimum because far fewer seals are required. And any time you eliminate seals you reduce maintenance, as well as possible problems, when high well pressures are encountered.
- Shaffer's design also means elimination of connections that require frequent oiling or greasing... elimination of exposed operating parts that can become corroded by chemical-laden muds or well-treating fluids... elimination of levers or yokes that can become jammed by loose boards, pieces of pipe, or other objects falling from the rig floor.

RESULT... When pressure emergencies threaten the safety of your well, Shaffer Blowout Preventers provide unequalled assurance of *positive* ram operation... and this is just one of the many "plus" advantages built into *every* Shaffer Blowout Preventer!*

THERE'S A SHAFFER BLOWOUT PREVENTER FOR YOUR PARTICULAR REQUIREMENT!

TYPE B and TYPE E Preventers are the units selected for most drilling applications. Type B has *non-rising* Locking Shafts for maximum compactness... Type E has *rising* Locking Shafts for quick ram indication.

TYPE XHP Preventers are ideal where extra-high well pressures are a problem. Each XHP unit is individually tested to 15,000 PSI *Working* Pressure in 7 1/16" Bore Size... to 10,000 PSI *Working* Pressure in 9" and 11" Bore Sizes.

TYPE LWS Preventers combine lightweight with adequate pressure rating for a wide range of applications. LWS units weigh approximately *half* as much as other Preventers of comparable size.

The above Preventers (except Type XHP) are available in choice of *Double* units *(two* Preventers unitized into one compact body for maximum space-saving)—or *Single* units.

See your nearest Shaffer representative for complete details. Or write direct!

*OTHER SALIENT SHAFFER ADVANTAGES...

- "Swing-Open" Doors for Quick Ram Changes!
- Space-Saving Compactness!
- Self-Cleaning Ram Compartments!
- Completely Enclosed Construction!
- "Floating" Ram Design!

...and still others your Shaffer representative will gladly explain to you!

38 years OF OIL TOOL LEADERSHIP

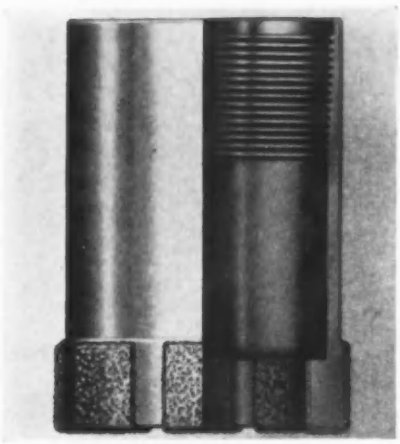
SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

CALIFORNIA SERVICE SHOPS: Santa Fe Springs, Santa Maria, Ventura, Avenal, Bakersfield and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Shaffer Tool Works, 6201 South Shields Boulevard
FARMINGTON, NEW MEXICO, Shaffer Tool Works, Post Office Box 546
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 827
HOUMA, LOUISIANA, Shaffer Tool Works, Post Office Box 1788
EXPORT SALES OFFICE: Shaffer Tool Works, 500 Fifth Avenue, New York, N.Y., U.S.A.
IN CANADA: Shaffer Western Hemisphere, Inc., 5823 103A Street, Edmonton, Alberta.

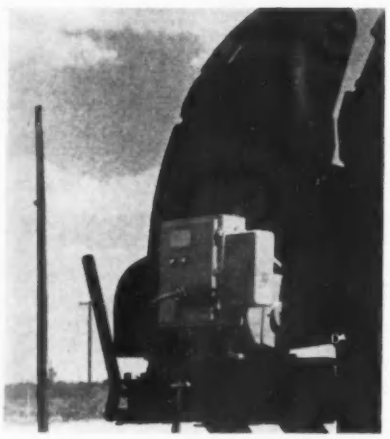
New literature

To get your copies, circle key numbers on postcard and mail to WORLD OIL.



Globaloy mill shoe is ideal for milling a wide variety of junk in a fraction of the time required by conventional shoes. Globaloy consists of sintered tungsten carbide particles which are applied to mill shoes by a special binding process which suspends the carbide particles in an extremely tough and shock absorbing matrix. (Globe Oil Tools Co. Supplements data on Pages 2105-2124, 1960-1961 Composite Catalog).

For more data, circle E16 on postcard



Electric Power Package

This new electric power package with controller motor and capaciter mounted and wired as one unit is now available through 60 horsepower for beam pumping units. Features include: Control circuit designed to fail-safe and lock-out if overload occurs; controls are wired 440-762 and easily connected in field for desired voltage; selective and definite sequence re-starting, and is electrically safe. Controller door can not be opened until power is unplugged. (I. W. Hynd Company).

For more data, circle E17 on postcard

Industrial Telemetering

Dresser Electronics, SIE Division, has published the first volume in a series devoted to a simplified explanation of Industrial Telemetering. Starting with the ABC's of land line codes, parity checks, weighted binary techniques, and many more basics of the petroleum automation business, the series will continue through an entire exposition of supervisory control and telemetering.

To get a copy, circle E18 on postcard

Converting Couplings

How new insert valves can be made up in casing couplings as an economical substitute for conventional cement collars is the subject of the new Baker Oil Tools, Inc., Technical Bulletin 382. Bulletin describes how these valves also feature a new coupling-to-valve seal which greatly improves the performance of this new type of equipment.

To get a copy, circle E19 on postcard

Casing Hangers and Heads

McEvoy Company has available a new eight-page brochure on their "controlled friction" casing hangers and McEvoy casing heads. Brochure defines their patented "controlled friction" principle and has graphic illustrations to explain its advantages. It also includes complete casing head and casing hanger specifications and performance curves on the casing hangers under full working pressures.

To get a copy, circle E20 on postcard

New Milling Tools

A new bulletin describing how mill-over time of a production packer or bridge plug can be reduced by as much as 75 percent by using Baker Packer Milling Tools has been announced by Baker Oil Tools, Inc. Bulletin gives actual case histories in which operators report that these tools resulted in substantial savings of time.

To get a copy, circle E21 on postcard

Air-Cooled Diesel Engines

Literature on the line of air-cooled diesel engines in two, three, four and six-cylinder sizes is available from the Ruston Paxman Division of Ruston & Hornsby, Ltd. The data include complete specifications, technical information and illustrations on installations of these engines as prime movers for many types of power requirements. Also included in the data are cutaway illustrations of construction features.

To get a copy, circle E22 on postcard

Small Diesel Engines

The Paxman Division of Ruston & Hornsby, Ltd., has made available new literature on the Class YB diesel engines of one and two-cylinders, ranging from 4 to 13-brake horsepower. Literature gives detailed diagrammatic information on the performance of these engines and includes detailed specifications, dimensional data and other technical information.

To get a copy, circle E23 on postcard

Epoch Pipe System

A 52-page engineering databook catalog is available from Bristol Aeroplane Plastics, Limited, giving information on the epoch pipe system now available from the company in sizes 6, 8, 12 and 15½-inches and for operating pressures up to as high as 600 pounds for the 6-inch pipe. Also included is a complete line of fittings, including flange adaptors.

To get a copy, circle E24 on postcard

Corrosion Resistant Hose

George Angus & Company has available literature on a recently developed "Drakeline" hose for oil industry applications. Literature describes the new hose as light in weight, more flexible, easy to handle and is resistant to oil and grease contamination. Hose is available in sizes from 1½ inch to 6 inches. Manufacturer states that 1,600 feet of 3-inch hose weighs only 775 pounds.

To get a copy, circle E25 on postcard